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### THESIS

**THE EFFECT OF COLLEGE SELECTIVITY, GRADES,  
AND MAJOR ON THE JOB PERFORMANCE OF  
OFFICERS IN THE U.S. NAVY**

by

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March 1998

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The results supported the hypothesis that for OCS operational officers, college selectivity has a positive impact on officer performance. Collegiate grade point average also showed a positive relationship. College major results showed a slight advantage for business/management majors in the promotion model, and a negative impact for staff officers with technical majors in the evaluation model. Females performed better than their male counterparts under these performance measures. Minorities received fewer evaluations RAP'd, but were not statistically affected at the Grade O-4 promotion board.

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JOB PERFORMANCE OF OFFICERS IN THE U.S. NAVY**

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Submitted in partial fulfillment of the  
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## **ABSTRACT**

Numerous studies in the civilian sector have documented a positive relationship between college selectivity, college major, and college grade point average and job performance. This thesis investigates if such a relationship exists in the United States Navy for a sample of Officer Candidate School (OCS) officers. The OCS sample was divided into separate operational and staff officers. Two measures of performance were employed in the models: (1) promotion to Grade O-4, and (2) the percentage of evaluations an officer was recommended for early promotion (RAP'd) from Grade O-1 through Grade O-3.

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## **I. INTRODUCTION**

### **A. BACKGROUND**

Numerous studies document that possession of a college degree has a positive effect on an individual's earnings potential. In the civilian labor market, these studies assume earnings are a proxy for an individual's true productivity and thus imply that college attendance has a positive effect on job performance. Other studies also indicate a positive relationship between a college's selection standards and the future earnings of its graduates. Finally, an individual's performance in college, as measured by grade point average and academic major, is linked with higher earnings.

In order to become a member of the U.S. Navy's officer corps it is necessary to obtain an undergraduate degree. All officers are assigned to managerial and professional positions. This thesis investigates whether graduation from a more selective college has a differential effect on an officer's performance as compared to graduation from a less selective college. The theoretical framework for this study employs the economic theory of human capital investment. This approach tests the hypothesis that officers who have attended more selective colleges acquire a larger stock of

human capital and, therefore, perform better than their peers from less selective schools.

This thesis also investigates the effects of grade point average and type of academic major on junior officer performance. The hypothesis is that those with higher grade point averages acquire a larger stock of human capital and those with specific majors, such as engineering and science, acquire a larger stock of specific skills. In addition, this thesis tests the hypothesis that certain majors are more important for success in the Navy.

Past studies focus on the relationship between college characteristics and worker productivity. Most of these studies lack a direct measure of productivity and instead rely on yearly or hourly earnings as proxies for productivity. These studies also analyze the effect of college selectivity and an individual's college grade point average on future earnings. The direct effect of cognitive skills on earnings is estimated along with the impact of college quality and individual academic performance.

This thesis uses a unique micro-level database of U.S. Navy officers who have graduated from over 563 private and public colleges and universities.<sup>1</sup> Contained in the

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<sup>1</sup> Bowman and Mehay, 1997.

database is relatively detailed information on promotion, prior officer performance in the Navy, supervisor performance ratings, and background information, such as college major and grade point average. The U.S. Navy's officer corps closely approximates an internal labor market which offers a rare opportunity to analyze worker, or in this case officer, productivity in the organization's well defined personnel system.

The relationship between college selectivity and job performance is important for several reasons. The Navy invests in an officer's human capital by awarding scholarships at highly selective colleges and universities which have Naval Reserve Officer Training Corps (NROTC) programs. The contributions of this thesis could be used in targeting specific types of schools in order to recruit those naval officers who are more productive as junior officers. If more selective schools produce officers who perform better than those from less selective schools, the Navy would benefit by stressing NROTC scholarships at those schools and by stressing graduation from such schools for Officer's Candidate School (OCS) accessions. Additionally, higher quality institutions tend to be more expensive. Whether the Navy or some other source is funding a college education, it is worthwhile to examine whether the

additional benefits of a college degree from a higher quality institution are worth the added costs.

## **B. OBJECTIVE**

The objective of this thesis is to obtain accurate estimates of the impact of college selectivity and individual collegiate performance on two measures of officer performance. The two performance measures are (1) promotion to Grade O-4 and (2) fitness report (FITREP) performance. FITREP performance is measured by the percentage of valid FITREPs from Grade O-1 through Grade O-3 in which the individual is recommended for early promotion. A more comprehensive definition of this performance measure is given in Chapter III. Using multivariate regression techniques, this thesis seeks to isolate differences in job performance between officers from colleges of varying selectivity and officers with different academic performance backgrounds. Academic majors and their effect on officer performance is also investigated.

## **C. SCOPE, LIMITATIONS AND ASSUMPTIONS**

This thesis focuses on the performance of officers from different undergraduate backgrounds. About one-third of all Navy officer accessions are from the United States Naval Academy (USNA), which is categorized as a highly selective institution. Similarly, the variation in quality of Naval

Reserve Officer Training Corps (NROTC) institutions is also small. Thus, officers from USNA and NROTC are omitted from the study to preclude possible selection bias. Consequently, the study results may not generalize to NROTC or USNA accessions.

Job specific training, in this case in the form of military training, is also offered through these accession sources and may affect future job performance in the fleet. The USNA or NROTC student typically receives more Navy-specific human capital training than Officer Candidate School (OCS) accessions. The vast majority of these future officers are attending highly selective colleges. The military training and college education received at USNA or an NROTC university, as well as college selectivity, is therefore highly correlated. If these individuals are not omitted from the database, college selectivity estimates may be biased upwards due to the high correlation with military training. The effect of the selectivity variable would be bundled with the impact of the accession source and the type of training. Officers with previous enlisted experience also receive job specific military training. If these individuals are not omitted with NROTC and USNA accessions, college selectivity estimates again may be upwardly biased

due to correlation with military training. Therefore, all officers with prior enlisted experience are omitted.

Selection bias is also present in the college selection process when an individual receives a NROTC scholarship. If a high school student accepts a NROTC scholarship, the choice of colleges he or she can attend is limited to those colleges with NROTC units. Rather than have the option of attending any college regardless of selectivity, the scholarship effectively limits the student's college choices and requires them to attend what most likely will be a highly selective institution. This again could lead to biased estimates of the effect of college selectivity on job performance for officers from NROTC units.

This study focuses on the effect of college selectivity on job performance. Current analysis techniques do not allow us to differentiate the individual effects of college selectivity and accession source on job performance, only the collective effect. Therefore in order to produce unbiased college selectivity estimates, USNA and NROTC accessions, as well as individuals with prior enlisted experience, are omitted.

A secondary reason to omit USNA and NROTC accessions in this study is the effect of college major on job performance. These accession sources steer their students

in the direction of technical academic majors, imposing a constraint on the student's choice of academic major. One portion of this study's measure of academic achievement includes college major. This administrative selection problem may therefore preclude an unbiased estimation of the true effect of college achievement on job performance, making the omission of individuals from these accession sources a prudent choice. By contrast, accessions via OCS typically are not constrained in their initial choice of an undergraduate major.

For the reasons explained above, the study is restricted to non-prior enlisted officers accessed through OCS. Officers accessed from OCS traditionally attend colleges with a greater variation in entrance selectivity standards. This focus provides less biased estimates of the effects of college selectivity, grade point average, and academic major on promotion.

#### **D. ORGANIZATION OF THE STUDY**

This study is organized into five chapters. Chapter II reviews pertinent literature and previous studies on the effects that college selectivity and academic performance have on job performance. Chapter III describes the data sets used in the thesis and discusses the specifications of the multivariate models. Chapter IV presents the empirical

results of the analyses of the models. Chapter V summarizes the results and provides conclusions based on the results.

## II. LITERATURE REVIEW

Past research efforts examining the effect of college selectivity and individual academic performance are characterized by two problems: the lack of a direct measure of job productivity, and databases which are unrepresentative of the populations from which they are drawn. Using the labor market theory that workers are paid according to their marginal productivity, most of these studies use salary or hourly wages as a proxy for job productivity. Some use data samples drawn from the National Longitudinal Study of the High School Class of 1972 (NLS-72) and from the High School and Beyond (HSB) Survey. Research is also conducted based on data derived from individual firms and colleges.

In most cases, a large portion of criticism regarding these studies focuses on the data used and its unrepresentative nature. What may be a weakness of these studies is a strength of this thesis. The unique database used in this study is described in detail later in Section III.

Early studies by Wise (1975a, 1975b) investigate the effects of both personal and college characteristics on worker productivity at a single firm. Again, no direct measure for on-the-job productivity is employed in the

study. Wise uses annual earnings as well as the frequency of promotion as proxies. The study also assumes relative job performance is reflected by the probability of promotion from one level to the next. The rate of upward movement is regarded as a more direct measure of performance than earnings.

Salary is usually assumed to match individual performance. Wise states the weakness in this assumption is that salaries are tied to positions within an organization, rather than to the performance of the individual filling the position at any one time. Therefore, the study reasons the differences between grade levels and rate of promotion may be a better proxy for job performance than salary.

Wise's data pertained to individuals working in a large manufacturing corporation employed in both technical and non-technical positions. The sample included only white males hired between 1946 and 1964 who were still employed by the firm in 1968 and who were not more than 30 years old when hired. A random stratified sample of 1,300 workers was selected for analysis from approximately 6,800 persons. Biographical information was collected on college selectivity, grade point average, and college major as related to worker performance.

Wise finds the relationship between college quality and grades and worker performance is "not only statistically significant but ... quantitatively important."<sup>2</sup> He also observes that persons from the most selective schools with the highest grade point averages have an estimated rate of salary increase which is twice that of graduates from the lowest selective schools with the lowest GPA's.

A second study (1975b) using the same data was done by Wise. It investigated the relationship between personal attributes, job performance, and the probability of promotion. The results concluded that for those with a bachelor's degree, the probability of promotion for those in the top 5 percent of their graduating class was greater than those in the lower two-thirds, .506 to .393, respectively. The results also implied that the effect of grade point average increased with school selectivity and the effect of selectivity increases with grade point average. Additionally, for those with graduate degrees the rate of promotion was found to increase with selectivity, grade point average, and rank in graduate school.

While Wise's studies support the hypothesis that job performance increases with college selectivity and grade point average, it has been criticized for several reasons.

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<sup>2</sup> Wise, 1975a.

First, the workers sampled are not a true representation of the United States' work force population. Women are entirely excluded, and workers who were hired during the period of 1946-1964 but who had since left the firm are ignored. Those who separate may have voluntarily left the organization for better jobs or perhaps higher pay. If the reasons these personnel left the firm are even casually related to college characteristics, the estimated impacts of these characteristics are biased.<sup>3</sup> Additionally, the internal labor structure of the organization is not described in either of the studies. Typical career paths, salary structure, and promotion policies are not described and likely underwent considerable change in the forty years covered by the study.<sup>4</sup>

Another type of criticism comes from one of Wise's peers, Edward Lazear, who states that Wise's "conclusion that college education contributes to productive ability is ... unwarranted."<sup>5</sup> Lazear feels Wise's results could also support the screening hypothesis of education just as well as the productivity-augmentation hypothesis. The productivity-augmentation hypothesis holds that schooling alters an individual's on-the-job productivity and that

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<sup>3</sup> Bowman and Mehay, 1997.

<sup>4</sup> Bowman and Mehay, 1997.

<sup>5</sup> Lazear, 1977.

grades index human capital acquired in college. The screening hypothesis states an individual's productivity is not altered; but rather the educational signal, such as graduation from a more selective school, serves as a screen which employers use to sort individuals. According to screening, the output enhancement of grades is solely through an informational role of differentiating individual ability levels to prospective employers.<sup>6</sup>

Regardless, from the individual's point of view whether schooling is a screen or a productivity-augmenter, it is almost always irrelevant.<sup>7</sup> Human capital analyses are consistent with both hypotheses. Moreover, the Navy as an employer should not be concerned as to *why* an individual performs better, just the methods to identify the characteristics which distinguish the more productive individuals.

Wise's studies, academic arguments aside, are important not only because of the positive relationship between selectivity, grade point average and job performance; but because they are some of the first to use performance measures other than salary. This thesis also uses promotion probability as a measure of job performance, but in the

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<sup>6</sup> Jones and Jackson, 1990.

<sup>7</sup> Lazear, 1977.

context of the well-defined internal labor market and career paths of the Navy's officer corps.

A 1990 study by Jones and Jackson investigated the impact of college grade point average on future earnings. They also examined whether the link between GPA and earnings was through the productivity augmentation hypothesis or the screening hypothesis. The data for the study was taken from a sample of 811 employed wage and salaried persons who had received a bachelor's degree from the same large Southern state supported university. All had been enrolled in the school's college of business administration. All information, except GPA, was collected through a survey mailed five years after graduation (1982-1985) to four graduating classes (1977-1980).

One problem with the study was that the surveys given to each class were not uniform. After requests for a specific income figure yielded a low response rate in 1982, the 1983 survey asked half of the class of 1978 for a specific figure and the other half for information in a categorical format. Since a categorical earnings question elicited a higher response rate, this format was used in the 1984 and 1985 surveys. In order to increase the sample

size, a predicted salary was calculated for those who did not respond to the salary question in 1982 and 1983.<sup>8</sup>

The small number of observations in the dataset, along with the statistical manipulation performed to increase the sample size, makes the data used in the study questionable. Also, the results are valid only for this single Southern university, and may not generalize to all college graduates important to the Navy.

At this large, state supported university, the study finds a positive and significant relationship between cumulative grade point average and earnings for the graduates of the college of business administration. While the authors note their estimates are larger than those obtained by Wise (1975b), Wise uses on-the-job productivity measures rather than solely earnings. In addressing the productivity-augmentation hypothesis versus the screening hypothesis, the study's conclusion is somewhat vague. They state this "examination ... extends little substantiation to screening but does provide evidence for not rejecting the

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<sup>8</sup> Jones and Jackson explain the sample size adjustments in this way..."Estimated values for salary nonrespondents in 1982 and 1983 have been obtained by regressing known specific earnings in each of these years upon a right hand variable of the percentage salary increase since the first position after graduation. This instrumental variable was selected because of its high correlation (1982, 0.88; 1983, 0.92) with reported annual salary."

human capital interpretation."<sup>9</sup> While it does not provide a ringing endorsement of either the productivity-augmentation or screening hypotheses, the study identifies a positive and significant relationship between cumulative grade point average and earnings.

Other studies also investigate the relationship between college selectivity, individual collegiate performance, and job performance. Wales (1973) uses the Gourman Rating of colleges as the selectivity measure in his study. The Gourman Rating is the average of the ratings of individual academic departments and specific subjects offered by a given college. Wales attempts to determine the extent "returns to higher education are due to the quality of the institution, after standardizing for various sociodemographic, background, and mental ability characteristics."<sup>10</sup> Again, a positive relationship between selectivity and earnings is found. Those who graduate from the top quintile of schools earn \$117 more per month<sup>11</sup> than those who graduate from the lower four-fifths of schools across the selectivity distribution.

Once again problems exist concerning the database used in the study. The data is extracted from the National

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<sup>9</sup> Jones and Jackson, 1990.

<sup>10</sup> Wales, 1973.

<sup>11</sup> 1969 dollar figures.

Bureau of Economic Research (NBER)-Thorndike dataset. This dataset, originally drawn in 1955, consists of Air Force personnel who volunteered for Pilot, Navigator, or Bombardier training programs during World War II. A battery of tests was given to these individuals in 1943. In 1955 Thorndike and Hagen studied the validity of the tests predicting the vocational success of a random sample of this group. In 1969 NBER mailed a questionnaire to many of the 1955 respondents to obtain information on a wide variety of items. As was the case with Wise's studies, the sample was not representative of all members of the labor market; but, again, a positive relationship between selectivity and earnings, a proxy for performance, was demonstrated.

More recently, researchers have used selected cohorts from the National Longitudinal Survey (NLS) of Youth. While a vast improvement over previous databases in terms of being nationally representative, the specific samples extracted from the NLS still may not be representative of the entire work force population.<sup>12</sup> Some studies use initial cohorts that are drawn from a representative national youth sample, but they lost much of that representation once much smaller subsets are extracted for analysis. Workers are aggregated

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<sup>12</sup> Bowman and Mehay, 1997.

over thousands of employers, each of which has its own employment requirements, policies, and promotion criteria.

One study utilizing this dataset was by Loury and Garman (1995). Using a cohort drawn from the NLS of the High School Class of 1972, they investigated the effects of college performance and selectivity on earnings. The NLS of 1972 originally consisted of 21,000 randomly selected individuals.<sup>13</sup> After this sample was initially interviewed in 1972, follow up interviews were conducted in 1973, 1974, 1976, 1979, and 1986 to determine post-high school progress. From this cohort Loury and Garman randomly selected 2,366 individuals for analysis. The sample drawn consisted of out-of-school males who had attended a four-year college for at least one year.

While the authors criticized previous empirical work, including Wise and Wales, for the unrepresentative nature of the data samples, Loury and Garman fail to recognize the same dilemma in their own study. The emphasis of their research is on college characteristics and individual collegiate performance, but their sample includes individuals who fail to attain a bachelor's degree (16.2 percent of whites and 27.2 percent of blacks).<sup>14</sup> The unrepresentative nature is also found in the racial makeup

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<sup>13</sup> Bowman and Mehay, 1997.

of the sub-set. The authors seek to specify separate estimates of college characteristic impacts on earnings for white and black college attendees. Yet only 164 blacks are included in the study (out of 2,366 individuals, or about 0.7 percent of the sample), far below the percentage in the population. Of these 164 individuals, approximately 95 (about 60 percent) completed more than four years of college, far greater than the percentage of blacks who hold a college degree in the population. Any of the study's conclusions about the effects of college experience on earnings for blacks are therefore preliminary at best.

These criticisms aside, the study finds both college selectivity and grade point average significant and positively related to earnings. The college major variables are found to be insignificant with the exception of business majors, which is positive and significant compared to those majoring in vocational studies for a white sub-sample. Another important conclusion is that "the results imply that past work that does not include measures of college performance overstates the effect of college selectivity for whites and understates it for blacks."<sup>15</sup> While we may doubt the conclusion for blacks due to the small number included in the sample, it is important to note the failure to

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<sup>14</sup> Loury and Garman, 1995.

analyze individual performance as a measure of productive and the use of earnings instead as a proxy for on-the-job performance. As individual collegiate performance is an integral component of this thesis, Loury and Garman's conclusions further support the inclusion of grade point average and college major in the model in this thesis.

Daymont and Andrisani (1984) conducted another study that used the NLS-72 data. Their analysis centered on the effect of job preferences and preparation (college major) on the gender differential in earnings. While the study's focus is not that of this thesis, its inclusion of college major lends more support to the model specification used in this thesis.

Previous research into this question investigates the causes of the substantial difference in earnings between men and women who were recent college graduates. Some of the discrepancy is accounted for by differences in productivity-related factors. The question is then posed: Is the remaining unaccounted difference in earnings due to gender discrimination or model misspecification?

Other researchers feel the earnings differences could be explained by different tastes for various types of work and/or the different way genders prepare for the labor

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<sup>15</sup> Loury and Garman, 1995.

market, such as the choice of a college major. Daymont and Andrisani argue that differences in preferences and tastes, and the preparations for labor market entry account for a substantial portion of the earnings differences. Our interest in this research applies to the effect of college major, which is a proxy for labor market preparation. Additionally, the results of Andrisani and Daymont's study could support the hypothesis that different academic majors, such as engineering and science, better prepare an individual for success in the labor market.

The authors use a natural logarithmic regression on 2,835 individuals (1,482 men and 1,353 women) drawn from the NLS-72. Average hourly earnings in their primary job are regressed against variables including: (1) preferences for various types of work, (2) field of college major, (3) job experience, and (4) gender. Preferences and tastes for types of work is collected in the senior year of high school and earnings information is taken from the 1979 survey. Preparation for the labor market is measured by dummy variables indicating major field of study for the highest degree attained.

The study finds that college major accounted for about one-quarter of the differences in earnings between young male and female college graduates. Males are also found

more likely to receive degrees in the fields of engineering and science. The results also indicate "that omission of work preferences and college majors leads to an overestimation of the degree of current labor market discrimination against young male and female college graduates."<sup>16</sup>

While these results do not directly address the focus of this thesis, they again lend support for the inclusion of college major in our model. If we are to obtain an accurate estimation of the effects of college selectivity and academic performance, college major needs to be included in the model. The results also indirectly infer that males with engineering and science degrees earn more in the labor market.

A more recent study also uses the NLS-72 data, but merges that data with other sources. James, Conaty, and To (1989) combine information from the NLS-72 with data from the Higher Education General Information Survey (HEGIS) and the Postsecondary Education Transcript Study (PETS). The authors attempt to identify those college characteristics which create an "aspect of quality."<sup>17</sup>

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<sup>16</sup> Daymont and Andrisani, 1984.

<sup>17</sup> James et al., 1989.

From the fifth follow-up of the NLS-72, which includes 12,841 men and women, 1,241 males were sampled. At face value this sample may seem similar to other all-male subsets drawn from the database, but in actuality it is quite different. These individuals all received college degrees, unlike the samples used in previous studies which include college attendees, particularly Loury and Garman (1995). In addition, their graduating institutions are identified, they completed at least 60 credit hours at their graduating institution, and they worked for an employer in 1985. These restrictions make the statistical analysis less complex, but bring with it the problem regarding the representation of the original NLS-72 cohort.<sup>18</sup>

In the sub-sample used, 519 colleges and universities were represented. The year 1975 was chosen as a representative year for the cohort. The characteristics of these institutions were obtained from the HEGIS, which conducts annual surveys of postsecondary four-year institutions. The college transcripts of the students in the sample were obtained from PETS. College experience variables were also derived from this source.

The study not only analyzes the effects of college quality on future earnings, it also takes into account

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<sup>18</sup> Bowman and Mehay, 1997.

student background variables, higher educational experience variables, and labor market variables. The college quality variables include a measure of college selectivity. For this the authors use the average Scholastic Aptitude Test (SAT) score of entering freshmen as an index of institutional selectivity. Other college quality variables include the percent of students who are part time, percent of graduating students with liberal arts majors, and percent of graduate school enrollments.<sup>19</sup>

The study finds positive impacts of college selectivity and grade point average on annual earnings. The average SAT score of the freshman class, a measure of selectivity, has a significant positive effect on earnings. A 100 point increase in the institution's average SAT score increases annual earnings about 3 percent.<sup>20</sup> This positive effect of the institution's average SAT score holds true regardless of the student's individual SAT score. An interesting aspect of this finding is that while institutional characteristics such as selectivity have a positive impact on annual earnings, they contribute a relatively small portion of the explained variance in earnings. Grade point average also

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<sup>19</sup> The authors' theory behind the inclusion of percentage of graduate school students as a college quality measure is that schools with more graduate students may be more focused on research instead of focusing on teaching undergraduate students.

has a positive effect on annual earnings, even when occupation is controlled. When GPA increases from C to B or from B to A, annual earnings rise about 9 percent. An individual's collegiate academic performance is found to have the most profound impact of any variable in their analysis of annual earnings.

The impact of specific academic majors is more difficult to determine. When comparing those majors imparting vocational or cognitive skills, neither has a decided advantage. But when majors are separated into more defined academic fields, the impacts of selecting an engineering or business major are significant and positively related to earnings. Selecting an education major has a significant and negative effect on annual earnings. Humanities, social sciences, mathematics, and biological/physical sciences are insignificant as compared to the omitted category composed of mainly vocational education majors.

The authors conclude "...while sending your child to Harvard appears to be a good investment, sending him to your local state university to major in engineering, take lots of math, and to preferably attain a high GPA is an even better private investment. Apparently, what matters most is not

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<sup>20</sup> James et al., 1989.

which college you attend but what you do while you are there."<sup>21</sup> The results of their study point to increased earnings for individuals who graduate from a more selective institution, but the effect is not as pronounced as the impact of individual performance. This research supports the inclusion of selectivity, grade point average, and college major in our job performance model.

The NLS-72 database is again sampled by Brewer, Eide, and Ehrenberg (1996). This study uses more complex modeling specifications compared to previous efforts. Earlier studies which estimated the economic return to college quality ignore that individuals are likely to attend a college based in part on their expected economic return and net costs. This study explicitly models a high school student's choice of college type based on individual and family characteristics.

In addition to using the NLS cohort data from the high school classes of 1972 and 1982, the study also utilizes the HEGIS and HSB surveys to gather more personal and institutional background information. The youth cohorts were surveyed at various stages in the life cycle: six years after high school (1972 cohort), ten years after high school (1982 cohort), and fourteen years after high school (1972

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<sup>21</sup> James et al., 1989.

cohort). Sample sizes are 3,062 for the 1972 cohort and 2,165 for the 1982 cohort. As in previous studies, individuals who do not complete a college degree are included with those who attained a bachelor's degree.

The only college characteristic applied in the model is college selectivity. Grade point average and college major are omitted.<sup>22</sup> Selectivity information is derived from Barron's *Profiles of American Colleges*. The Barron's ratings are divided into six classifications of quality type: most competitive, highly competitive, very competitive, competitive, less competitive, and non-competitive. The authors further group the six categories into three categories of "top or elite", "middle", and "bottom". This threefold grouping is employed because there are too few public institutions in the most competitive group.

Although the study controls for a student's systematic college selection process, based on expected returns and net costs, they find little evidence that the statistical correction affected the basic results. The study finds that attendance at an "elite" private institution is associated with a "sizable and significant wage premium" compared to

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<sup>22</sup> Note that James et al. find the estimated effect of college selectivity would be biased upward with the omission of individual performance and academic major. (Conclusion from Bowman and Mehay, 1990).

the omitted group, "bottom" public institutions.<sup>23</sup> A smaller wage premium is associated with attendance at middle rated private institutions compared to the omitted category. There is also evidence this wage premium increases over time within a given cohort. Evidence of a wage premium for attending an "elite" public university is found to be weaker.

Bowman and Mehay laid the foundation for this thesis in their 1997 study. Utilizing the same database as this thesis, they analyze the impact of college quality and academic performance on job performance of naval officers. The database, which is described in Chapter III in detail, consists of 24,672 operational officers and 9,356 similar staff officers who are automatically considered for promotion to Grade O-3. The database follows the careers of naval officers who began their careers between 1976 and 1985. The first ten years of the officers' naval careers are covered by the database and all officers are college graduates.

Bowman and Mehay study the effects of college experiences and personal characteristics on two separate officer communities in the Navy: operational and staff. Their results mirror those of previous civilian workforce

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<sup>23</sup> Brewer et al., 1996.

studies, which find collegiate performance and college selectivity has a positive impact on earnings. The Bowman/Mehay study finds that "even after controlling for grades and majors, graduates of elite colleges are more productive in the work place."<sup>24</sup>

The results also support prior research's findings of a positive relationship between academic achievement and earnings. Those with better grades in college are rated more favorably in supervisor's performance evaluations and are more likely to promote to Lieutenant Commander (LCDR, Grade O-4). Surprisingly, the study fails to support the hypothesis of a positive relationship between technical majors and earnings. Their study finds "an inverse relationship between officers with technical degrees and on-the-job performance ... and to have no significant effect at promotion to Grade O-4."<sup>25</sup> This is contrary to civilian studies that identify an earnings premium for technical majors.

While this thesis is based on the Bowman/Mehay research and will use the same database, several elements will be altered. The Bowman/Mehay study includes officers accessed through the USNA and NROTC sources. As previously outlined in Chapter I, this thesis assumes any estimation of the

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<sup>24</sup> Bowman and Mehay, 1997.

impact of selectivity on job performance may be biased by the high correlation between these accession sources and attendance at a highly selective institution. Therefore, officers who enter the Navy from these programs will be omitted.

Additionally, the Bowman/Mehay study uses all six categories of Barron's college selectivity rating. In this thesis, these six categories will also be further classified into three groups to obtain estimates of the impact of college selectivity on job performance.<sup>26</sup> This grouping will permit the results derived in the thesis to be compared with earlier studies. Previous studies found this threefold classification desirable since there were too few public institutions in the top Barron's selectivity categories.<sup>27</sup> While this thesis will not differentiate between public and private institutions, we feel the effect of college selectivity, especially in the top categories, is adequately represented by three groupings. When using six groups, small numbers of institutions in some of the groups make the results less reliable. In addition, it is unlikely that the difference between the six groups will be as large as the difference between the three grouping scheme.

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<sup>25</sup> Bowman and Mehay, 1997.

<sup>26</sup> This is the same method used by Brewer et al., 1996.

<sup>27</sup> Brewer et al., 1996.

Previous literature has clearly demonstrated a positive relationship between college selectivity, individual academic performance, and earnings, which is a proxy for on-the-job productivity. Some studies include the probability of promotion to the next grade as a measure of performance.<sup>28</sup> What most of these studies lack is data from a uniform organizational structure for all individuals. One must assume that the employment and hiring policies at the different organizations are varied, possibly affecting the results of some studies. Other studies, which analyze individuals from a specific college or at one organization, are plagued with small sample sizes or included non-college graduates.

The database used in this study allows a unique opportunity to study the effects of selectivity and individual academic performance on job performance. While specific to the effect on officers in the Navy, these naval officers come from disparate backgrounds and institutions. The background information included in the database on each individual is extensive. The Navy's organizational structure and officer career paths are well defined. The variety of backgrounds and institutions of the individuals in the data file, coupled with a large sample size and a

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<sup>28</sup> Wise, 1975a and 1975b.

single employer, affords an excellent opportunity for further study into the impacts of college selectivity and individual collegiate performance on job performance.

From the Navy's standpoint, this study is worthwhile for several reasons. The Navy funds college education at many highly selective and costly universities. Are the additional outlays beneficial? If they are, the Navy may benefit by stressing scholarships at elite institutions and recruiting officers from these same colleges. In this era of dwindling defense budgets, all military expenditures are being scrutinized. Whether the Navy or some other source is funding a college education, it is worthwhile to examine whether the additional benefits of a college degree from a higher quality institution are worth the added costs.

### **III. DATA AND METHODOLOGY**

This chapter discusses the database used in the study and how it is employed to develop the explanatory variables. Additionally, this chapter defines in detail the measures of performance introduced in Chapter I. The statistical methodologies are also explained, along with the hypothesized effects, positive or negative, of the explanatory variables on the selected performance measures. Table I displays the variables used and the predicted impact on the performance measures employed in the thesis.

#### **A. DATA**

##### **1. Database used in thesis**

Professors William R. Bowman (USNA) and Stephen L. Mehay (NPS) compiled the database used in this analysis. Three separate data files are merged to create a comprehensive officer database which includes information on 24,672 operational officers and 9,356 similar staff officers who are automatically reviewed for promotion to Lieutenant (Grade O-3). The database tracks officers who began their naval careers between the years 1976 and 1985, and follows them through their first ten years in the Navy. Any officer leaving the service due to medical restrictions or death is excluded.

As previously stated, the database is compiled by merging three separate files. The first file utilizes information from the Navy History Promotion Files. This file contains the outcomes of all promotion boards for fiscal years 1980 to 1995. The promotion file is merged with a Navy officer background file containing information from the Officer Data Card (ODC). This file contains individual background information, Navy experience, and promotion selection board results for all officers going before the Lieutenant (LT/Grade O-3) selection board between fiscal years 1980 and 1990 and the Lieutenant Commander (LCDR/Grade O-4) selection board between fiscal years 1985 and 1995.

A second data file, the Officer Loss File obtained from the Defense Manpower Data Center (DMDC), is used to determine the timing and reason why any officer in the data set has departed active duty. The final data file used is a longitudinal profile of all officer fitness reports, obtained from Naval Personnel Research and Development Center (NPRDC). This file summarizes data from the fitness reports (FITREPs) of nearly 90 percent of the officers in the data set. Officers receive these competitive evaluations at least once per year. FITREP evaluations are also written for each officer whenever they leave a command or when their reporting senior rotates out of their command.

The resulting data set amassed by Bowman and Mehay contains comprehensive data on each officer. Demographics, college background, and detailed performance evaluations throughout the first ten years of an officer's career are included in addition to the outcomes of both LT and LCDR promotion selection boards. As such, the dataset closely approximates a longitudinal file, since each officer is tracked from the Grade O-3 promotion board until they leave the Navy or through the results of the Captain (Grade O-6) promotion board. The detailed information on the individual's college quality and college performance, coupled with a history of their naval career, offers a unique opportunity to explore the effects of college selectivity and individual collegiate performance on the performance of naval officers in the first ten years of their careers.

From this dataset, only OCS officers are sampled for analysis. This sample is divided into two groups: operational officers and staff officers. The operational officer sub-sample includes those officers in the warfare communities of Surface Warfare (SWO), Submarine (SUB), Pilot (PLT), Naval Flight Officer (NFO), and other URL communities (OTHURL) such as SEALS (Sea Air and Land) and EDO (Explosives Ordinance Disposal). The General

Unrestricted Line (GURL) community, although defined as an operational community, is intentionally omitted from this sub-sample. This is done because the community, now redesignated Fleet Support, has a mission which is non-tactical and therefore more closely resembles a staff or restricted line community. The staff officer portion of the sample consisted of those job specialties which are support in nature. Supply Corps, Civil Engineering Corps, and the Restricted Line communities are examples of communities included in the staff sample. Medical and Dental Corps officers are omitted in the original dataset and are not included in this study.

The OCS-Operational data file contains 2,911 officers in the promotion model<sup>29</sup> and 5,329 officers in the FITREP performance model.<sup>30</sup> All OCS officers with prior enlisted experience are omitted and do not impact these numbers.<sup>31</sup>

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<sup>29</sup> 228 individuals are omitted from the operational promotion model due to the following missing values in the data file: grades (218) or age at commissioning (10).

<sup>30</sup> 4064 individuals are omitted from the Operational FITREP performance model due to the following missing values in the data file: FITREP values (2619), grades (2085), or age at commissioning (21). Note: The sum of the missing values for FITREP, grades, and age does not total to 4064 due to multiple missing values in individual records.

<sup>31</sup> Officers with prior enlisted experience are omitted to preclude the impact of previous military related training on officer performance.

The OCS-Staff data file contains 2,240 officers in the promotion model<sup>32</sup> and 2,912 officers in FITREP performance model.<sup>33</sup> Again, OCS officers who had prior enlisted experience are omitted due to differences in prior military training and experience between them and other officers accessed through the OCS program.

## **2. Dependent Variables**

The following is a brief discussion of the two dependent variables, how each is calculated, and why each is chosen as a measure of performance. Table I displays the variables and their predicted impact on the performance measures. Additionally, Appendix A presents the variable names and a brief description of them.

### **a) PROMO**

The dependent variable in the first model is PROMO. It indicates whether or not the individual is promoted to LCDR (Grade O-4). It is a dichotomous variable with a value of 1 if an individual is selected for

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<sup>32</sup> 2 individuals are omitted from the Staff promotion model due to missing grades.

<sup>33</sup> 1093 individuals are omitted from the Staff FITREP performance model due to the following missing values in the data file: FITREP values (603), missing grades (611), or age at commissioning (1). Note: The sum of the missing values for FITREP, grades, and age do not total to 1093 due to multiple missing values in individual records.

TABLE I. EXPECTED IMPACTS OF EXPLANATORY VARIABLES

VARIABLE	EXPECTED IMPACT ON PERFORMANCE MEASURES
<b>College Quality - 6 Categories</b>	
"most competitive"	+
"highly competitive"	+
"very competitive"	omitted
"competitive"	-
"less competitive"	-
"non-competitive"	-
<b>College Quality - 3 Categories</b>	
BARRONHI	+
BARRONMD	+
BARRONLO	omitted
<b>College Major</b>	
Engineering	?
Physical Science - Biology	?
Math	?
Social Science	?
Business/Economics	?
Humanities	omitted
<b>Other Education Variables</b>	
Grade point average	+
Graduate Degree	+
<b>Navy Officer Community</b>	
Surface Warfare	omitted
Pilot	?
Naval Flight Officer	?
Other URL	?
General Unrestricted Line	omitted
Staff	?
Restricted Line	?
<b>Demographics</b>	
Single	omitted
Married only	+
Married with children	+
Divorced with children	?
Male	omitted
Female	-
White	omitted
Minority	-
Age at commissioning	?

promotion in early or in zone<sup>34</sup> and 0 if the individual fails to select for promotion in zone. As this variable is measuring the probability of promotion, only individuals who stay to the O-4 selection board are included in the promotion model. In contrast, the second dependent variable, percentage of fitness reports RAP'd from Ensign (ENS/Grade O-1) through LT, includes all officers who reached the rank of Lieutenant (O-3) even if they do not remain to the Lieutenant Commander selection board. This accounts for the disparity in the number of observations between the two models.

Promotion to Grade O-4 is employed as a proxy for performance based on previous research, including that of Wise (1975a, 1975b), which is described in Chapter II. Wise also uses rate of promotion, how quickly one advanced in the organization, as a proxy for performance. Given the Navy's rigidly defined promotion system and time in grade requirements, the implementation of such a variable in this study is not practical.

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<sup>34</sup> An "early" promotion occurs when an officer is promoted to Grade O-4 before their cohorts. An "in zone" promotion occurs when an officer is promoted at the same time as their cohorts. "Early" promotion accounts for less than 5 percent of all Grade O-4 promotions.

**b) PCTRAP13**

The second dependent variable is measured as the percentage of FITREPs between the grades of O-1 and O-3 on which an officer receives a recommendation for early promotion. PCTRAP13 is the variable name given to the dependent variable in the FITREP model. It is a continuous variable with a theoretical range of 0 to 100 percent. Recommendations for early promotion (RAPs) are a direct reflection of an officer's performance during this period, and likely a better measure than written comments of a Commanding Officer about an individual. This is due in part to the gradual inflation of fitness reports over time and the reluctance of senior officers to place negative information in the comment section of evaluations. Additionally, promotion boards rarely take into account the written comments, instead relying on whether an individual was RAP'd and an individual's numerical ranking against their peers.

PCTRAP13 is calculated by summing the number of FITREPs in which an officer is recommended for early promotion during Ensign through Lieutenant (Grade 01 through Grade O-3) and dividing that by the number of "valid" FITREPs the officer receives in the same period. A valid FITREP is defined as a report in which an officer is

evaluated by a senior against other peers in the same grade, known in the Navy as a "competitive" FITREP. Additionally, to qualify as a valid FITREP the officer has to have been evaluated "closely" for at least 6 months. FITREPs not included in the calculation of PCTRAP13 are those classified as "non-observed", and therefore "non-competitive", reports in which an officer is in their billet for less than six months and FITREPs received when departing a command.

### **3. Independent or Explanatory Variables**

The independent variables used in the models can be grouped into five categories: (1) college quality; (2) college major, grade point average and graduate school; (3) demographics; and (4) year dummy variables. These five categories provide a significant amount of information on the individual and the college an officer attended.

#### **a) College Quality**

College quality is captured in the model by employing a six-fold classification system derived from Barron's *Profiles of American Colleges*. Barron's rates colleges on the basis of entering students' high school class rank, high school grade point average, average freshman class SAT scores, and the percentage of applicants admitted.<sup>35</sup> Barron's quality rating system assigns colleges

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<sup>35</sup> Barron's *Profiles of American Colleges*, 1995.

one of six levels of competitiveness: (1) most competitive, (2) highly competitive, (3) very competitive, (4) competitive, (5) less competitive, and (6) non-competitive.

For this thesis, the same college quality classifications are employed. There is some concern about using a base year quality rating and then applying it to all individuals regardless of the year they graduated from college. Do these ratings change over time? Kingston and Smart (1990) note there is little change across time in institutional rankings. The Barron's college selectivity ratings used in this thesis are from the 1980 edition. This year is chosen since it coincides with the mid-point of years covered in this study. College quality variables are binary in nature and assume a value of 0 if an individual's undergraduate institution is not rated in that quality category and a value of 1 if the institution is rated in that quality category.

Additionally, the models are run with the Barron's rating grouped into three categories. BARRONHI contains Barron's "most competitive" and "highly competitive" colleges, BARRONMD contains Barron's "very competitive" and "competitive" colleges, and BARRONLO contains Barron's "less competitive", "non- competitive" colleges. This is done to facilitate comparison to previous studies which

employ a similar grouping system. These three quality variables are also binary and assume a value of 1 if true and 0 if false. BARRONLO is the omitted category.

Previous research suggests that the more selective an institution is, the more likely the graduate will perform well in the Navy. That is, a positive relationship exists between college quality and job performance. Therefore, we expect that more selective schools in our model will have a positive impact on PROMO and PCTRAP13.

**b) College Major, GPA, and Graduate School**

This category includes college major, grade point average, and master's level education. An individual's undergraduate college major is placed into one of six categories: engineering, biology-physical sciences, math/computer sciences, social sciences, business/economics, and humanities. The variables are dichotomous with a value of 0 if false and a value of 1 if true.

These variables are included in the model to test the hypothesis that some majors are more important for success in the Navy. Previous literature is divided on this issue, but Bowman (1990) found that technically oriented majors have no advantage over non-technical college majors in officer job performance. In light of opposing

literature, we are unsure how college major will effect job performance.

Grade point average (GPA) is also included in the model as a measure of a student's academic achievement. This variable is calculated using the Navy's Academic Performance Code (APC1) and the code is assigned to every officer based on their academic performance in college. The APC utilizes a three-digit code. Each digit of the APC is assigned as described below:

1. Undergraduate Grade Point Average is an assigned value ranging from 0 to 5, 0 being the highest GPA range and 5 being the lowest GPA range;
2. Math Qualification Code is an assigned value ranging from 0 to 6 in ascending order of calculus difficulty and performance;
3. Technical Qualification Code is an assigned value ranging from 0 to 5 in ascending order of physics difficulty and performance.

The GPA variable used in the model is continuous and is defined as:  $GPA = (5 - APC1)$ .<sup>36</sup> This equation allows us to closely approximate the actual collegiate grade point average on a five-point scale. The actual cumulative grade point average is not available from officer records, necessitating the use of this measure. Based on previous

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<sup>36</sup> An APC1 value of zero equates to a GPA in the 3.6 to 4.0 range on a 4 point scale. The remaining ranges are as follows: 3.2 to 3.59 = 1, 2.8 to 3.19 = 2, 2.4 to 2.79 = 3, 2.0 to 2.39 = 4, and below 1.99 equates to an APC1 code of 5.

research described in Chapter II, we expect GPA to have a positive impact on the job performance of naval officers.

The final variable in the education grouping is graduate education (GRADSCH). GRDSCH is a binary variable which has a value of 0 if the officer does not complete graduate school and has a value of 1 if the officer has completed graduate school. We predict, based on human capital theory, GRADSCH will have a positive impact on job performance by enhancing an officer's stock of human capital.

**c) Designator/Community**

This variable classification identifies an officer's professional community. The community variables used in the operational models are Surface Warfare (SWO), Submarine (SUB), Pilot (PLT), Naval Flight Officer (NFO), and other URL communities (OTHURL) such as SEALs or Underwater Demolition. The staff community models consist of General Unrestricted Line (GURL), Restricted Line (RL), Supply Corps and other Staff Corps (STAFF). These variables are binary and have a value of 1 if the individual is a member of the community and have a value of 0 if they are not members of the officer community.

We have no prediction on the effects of these variables. They are being included to account for the

different career paths the communities follow. Theoretically, the promotion rate to Grade O-4 for all communities is approximately 75 percent. Therefore there should not be any great differences among the communities. However, promotion is based on vacancies, which can differ across communities for any given promotion board.

**d) Demographics**

Demographic variables are included to account for the different backgrounds of each officer and to investigate the impact each has on the job performance of OCS officers. Variables indicating marital status are SINGLE, married with no children (MARONLY), married with children (MARCHILD), or divorced with children (DIVCHILD). In the promotion model, marital status is measured at the Grade O-4 selection board since all officers in this model remained to this career point. In the FITREP models, marital status is measured earlier in an officer's career at the Grade O-3 selection board. This is necessary since not all officers in the FITREP model remained to the Grade O-4 board. This may account for a greater percentage of married OCS officers in the promotion models than present in the FITREP models. Their marital status is polled later in their professional and personal lives.

Gender (MALE or FEMALE), race (WHITE or NONWHITE), and age at commissioning (AGE) are also included in all model specifications. Each variable, except AGE, is binary in nature and has a value of 1 if true and had a value of 0 if false. AGE is a continuous variable.

Our expectation is that being non-white or female will have a negative effect on PROMO and PCTRAP13. In the marital status group, we expect that a married officer (with or without children) will be more likely to promote and receive better FITREPs than single officers or divorced officers with children.

**e) Year Dummy Variables**

Year dummy variables are included in the model to control for differences in yearly promotion. These variables are binary in nature and assumed a value of 1 if true and 0 if false. In the promotion model, the dummy variable is defined as the year in which the individual officer went to the Lieutenant Commander (Grade O-4) selection board. These variables (FYxx) controlled for variations in promotion rates and board composition through the years covered.<sup>37</sup>

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<sup>37</sup> A dummy variable for FY92 could not be constructed due to a coding error in the original data file. Therefore FY92 is omitted from this study.

In the FITREP model, the dummy variable is the year in which the individual officer is promoted to Grade O-2 (JGYGxx). Although the year commissioned, or "year group" would be the logical choice to control for each cohort, there is an error in the original database for this parameter. Therefore, the year in which an officer is promoted to Grade O-2 was employed for the year dummy variable.

All variable names, a brief description of them, and the predicted impacts are located in Appendix A.

## **B. METHODOLOGY**

The goal of this thesis is to determine the impact of college selectivity and individual collegiate academic performance for OCS commissioned officers on two measures of officer performance: (1) promotion to O-4, and (2) percentage of FITREPs recommended for early promotion between Grade O-1 and Grade O-3. For each performance measure, two separate model specifications are implemented. Additionally, the promotion and FITREP models employ different statistical techniques.

The first model specification measures the marginal effect of college selectivity on promotion. A second model specification employs a three category Barron's grouping. Both models include an individual's education

characteristics: college major, grade point average, and graduate education received. The following paragraphs outline the two models and the statistical technique used in each.

**a) Promotion Model**

As previously discussed, the promotion model variable PROMO is a dichotomous variable, one which can assume a value of either 0 if false or 1 if true. Due to the dichotomous nature of this dependent variable, a logit model is estimated. While a linear regression may be less complex, a logit model is more efficient for binary dependent variables.

The logit technique is one of two methods designed for the analysis of dichotomous variables, the other method being the probit method.<sup>38</sup> By using the logistic method,

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<sup>38</sup> The logit technique uses the logistic Cumulative Distribution Function (vice the normal CDF used with the probit model) to estimate a model. If  $Y=1$  means that an officer was promoted to Grade O-4 and  $X_i$  symbolizes a vector of explanatory variables, then the probability that an officer will promote to Grade O-4 ( $P_i$ ) can be represented by:

$$P_i = E(Y=1|X_i) = 1/(1+e^{-Z_i})$$

where:  $Z_i = \beta_1 + \beta_i x_i$

This formulation allows for  $Z_i$  to range from  $-\infty$  to  $+\infty$ , while  $P_i$  is restricted between 0 and 1 and is nonlinearly related to  $Z_i$ . While logit and probit methods produce similar results, the difference lying in the CDF

"it is possible to transform the dichotomous dependent variable into a new random variable that shares the properties of being unbounded and continuous so that the probability of observing the transformed values can take on values bounded by 0 and 1."<sup>39</sup> It also allows for the estimation of the impact of each explanatory variable on the likelihood of promotion to Lieutenant Commander (Grade O-4).

The specification for the promotion model for the operational communities is as follows:

PROMO = f (MOST COMPETITIVE, HIGHLY COMPETITIVE, COMPETITIVE, LESS COMPETITIVE, NON- COMPETITIVE, ENGINEER, PHYSICAL, MATH, SOCSCI, ECON, GPA, GRADSCH, SUB, PILOT, NFO, OTHURL, MARONLY, MARCHILD, DIVCHILD, FEMALE, NONWHITE, AGE, FY86, FY87, FY88, FY89, FY90, FY91, FY93, FY94, FY95).

The specification for the promotion model for the staff communities is as follows:

PROMO = f (MOST COMPETITIVE, HIGHLY COMPETITIVE, COMPETITIVE, LESS COMPETITIVE, NON- COMPETITIVE, ENGINEER, PHYSICAL, MATH, SOCSCI, ECON, GPA, GRADSCH, MARONLY, MARCHILD, DIVCHILD, FEMALE, NONWHITE, AGE, FY86, FY87, FY88, FY89, FY90, FY91, FY93, FY94, FY95).

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used. The choice between the two is one of mathematical convenience and availability of computer software. Generally, the logit model is preferred. (see Gujarati, Damodar N., Basic Econometrics, Third Edition, McGraw Hill Book Company, 1995. Chapter 16)

<sup>39</sup> Bowman, William R. "Regressions for Dichotomous Variables" U.S. Naval Academy class handout, 1996.

**b) FITREP Performance Model**

The dependent variable used in this model, PCTRAP13, is defined as the percentage of evaluations in which an officer is recommended for early promotion between Grade O-1 and O-3. As this is a continuous variable, vice the dichotomous variable used in the promotion model, a linear model is specified and estimated using the method of ordinary least squares to derive parameter estimates in both model specifications.

The specification for operational FITREP model is as follows:

```
PCTRAP13 = f (MOST COMPETITIVE, HIGHLY COMPETITIVE,
               COMPETITIVE, LESS COMPETITIVE, NON- COMPETITIVE,
               ENGINEER, PHYSICAL, MATH, SOCSCI, ECON, GPA, SUB,
               PILOT, NFO, OTHURL, MARONLY, MARCHILD, DIVCHILD,
               FEMALE, NONWHITE, AGE, JGYG79, JGYG80, JGYG81,
               JGYG82, JGYG83, JGYG84, JGYG85, JGYG86, JGYG87).
```

The specification for the staff FITREP model is as follows:

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PCTRAP13 = f (MOST COMPETITIVE, HIGHLY COMPETITIVE,
               COMPETITIVE, LESS COMPETITIVE, NON- COMPETITIVE,
               ENGINEER, PHYSICAL, MATH, SOCSCI, ECON, GPA,
               MARONLY, MARCHILD, DIVCHILD, FEMALE, NONWHITE, AGE,
               JGYG79, JGYG80, JGYG81, JGYG82, JGYG83, JGYG84,
               JGYG85, JGYG86, JGYG87).
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Each model was also run with the college quality measure bundled in three groups. The results from these runs are included in the appendices, but will not be specifically addressed in Chapter IV. The results mirror

those of the six-category grouping and offer little new information to this study.

In summary, these models (PROMO and PCTRAP13) are constructed in order to estimate the sole impact of college selectivity and then the impact of college selectivity coupled with the impact of individual collegiate performance on the job performance of officers accessed through the Officer Candidate School program. Using these models, the intention is to identify the effect college selectivity and individual performance have on an officer's performance in the Fleet.

#### **IV. EMPIRICAL ANALYSIS**

This section of the thesis analyzes the results of the promotion and FITREP performance models in both the operational and staff communities for officers entering the Navy through the OCS program. Table II shows the mean values of selected variables used in the study.<sup>40</sup> Tables III, IV and V analyze the marginal effects of selected variables in the promotion and FITREP models.

##### **A. OPERATIONAL AND STAFF COMMUNITY COMPARISON**

Before examining the modeling results, it is useful to analyze the mean values of the dependent and explanatory variables for the operational and staff communities. Table II displays the means for the promotion model which includes only officers who stayed to the Grade O-4 selection board. Several aspects of the variable means are important to note, as they emphasize the vast differences between the operational and staff communities. The means discussed in this section are taken from the promotion models. Some of the most striking differences between the operational and staff communities are:

1. 69 percent of operational and 68 percent of Staff OCS officers attended colleges that are "very competitive" or "competitive";

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<sup>40</sup> A complete list of variables' names, means, and standard deviations for all models is located in Appendix II.

**TABLE II. VARIABLE MEANS OF OPERATIONAL AND STAFF COMMUNITIES**  
(OFFICERS WHO STAYED TO GRADE O-4 BOARD)

<b>VARIABLES</b>	<b>OPERATIONAL</b> 2,911 Observations	<b>STAFF</b> 2,240 Observations
Promotion to Grade O-4	.757	.737
<b>College Quality</b>		
Most Competitive	.025	.023
Highly Competitive	.072	.062
Very Competitive	.326	.329
Competitive	.370	.348
Less Competitive	.099	.097
Non Competitive	.069	.060
<b>College Major</b>		
Engineering	.148	.050
Physical Science	.223	.176
Math	.036	.042
Social Science	.167	.192
Business/Economics	.201	.266
Humanities	.147	.229
<b>Other Education Factors</b>		
GPA 3.6 to 4.0	.055	.083
GPA 3.2 to 3.59	.165	.237
GPA 2.8 to 3.19	.448	.499
GPA 2.4 to 2.79	.271	.158
GPA 2.0 to 2.39	.057	.021
GPA below 2.0	.005	.001
Graduate Degree	.175	.294

**TABLE II. (CONT.) VARIABLE MEANS OF OPERATIONAL AND STAFF  
COMMUNITIES**  
(OFFICERS WHO STAYED TO GRADE O-4 BOARD)

<b>VARIABLES</b>	<b>OPERATIONAL</b> 2,911 Observations	<b>STAFF</b> 2,240 Observations
<b>Navy Officer Community</b>		
Surface Warfare	.281	-
Submarine	.090	-
Pilot	.363	-
Naval Flight Officer	.258	-
Other URL Communities	.008	-
Staff	-	.313
Restricted Line	-	.335
General Unrestricted Line	-	.352
<b>Demographics</b>		
Married w/ No children	.249	.178
Married w/ Children	.536	.366
Divorced w/ Children	.016	.028
Single	.199	.428
Female	.017	.431
Male	.983	.569
Minority	.036	.070
White	.964	.930
Age at Commissioning	23.9	24.4

2. Females account for only 1.7 percent of the operational sample and 43.1 percent of the staff sample;
3. Only 17 percent of OCS operational officers at the Grade O-4 board have graduate education while 29.4 percent of OCS staff officers have graduate education;
4. 81.9 percent of OCS staff officers have college GPA's greater than 2.80, while in the operational sample 66.8 percent have GPA's above 2.80;
5. In the operational communities, 75.7 percent are promoted to Grade O-4 while in the staff communities, 73.7 are promoted to Grade O-4;
6. 53.6 percent of OCS operational officers are married with children compared to only 36.6 percent of staff officers;
7. Staff officers are slightly older, on average, when entering the Navy.

These means point to both the differences and similarities between the two communities. Both communities access the majority of their officers from mid-rated colleges. Approximately 70 percent of operational and staff OCS officers are accessed from "very competitive" or "competitive" institutions. There is an uneven distribution throughout the college selectivity spectrum.

The low percentage of females in the operational models will force us to be cautious in the interpretation of any

models which include variables for gender. For the period covered in this data, many "combat" and jobs with warfare specialties, most of the operational communities, were closed to women. Today, the majority of these occupations have been opened to women with the exception of SEAL's and submarines. A database which includes these changes would assist in the study of women in the URL.

The education category means are interesting since the staff communities have a higher percentage of individuals with a Master's degree than the operational communities. This could be due to the emphasis placed on graduate education in the staff communities and a lack of emphasis on graduate education in the operational communities. The grade point averages are also sharply different, with more individual in the staff communities having higher APC categories. This could be due to more specialization in the staff communities. The staff communities are more likely to recruit an individual with a specific background, such as civil engineering, which may in part account for the higher GPA's. The staff communities also appear to be more selective regarding grades, while college quality mirrors that of the operational communities.

The mean values of variables for those officers in the OCS operational and staff communities paint a disparate

picture for each community. Analysis of the means is conducted to explain the differences between the communities and also to support the decision to separate the two communities for analysis.

## **B. MULTIVARIATE ANALYSIS**

This section describes the results obtained for each model in the Operational and Staff communities for a sample of OCS officers. Each category of explanatory variables will be analyzed as a group in order to facilitate comparison between the models. Tables III and V display the marginal effects for each model. Table IV displays the promotion model marginal results for grade point average ranges coinciding with APC codes. The full model results are given in Appendices C through J.<sup>41</sup>

### **1. College Quality**

The first estimates analyzed are from the college quality category. The marginal effects of the college quality variables are shown in Table III. In previous literature, attendance at a highly selective college is linked with an increase in post-college earnings, a proxy for job performance. For OCS officers in this sample, college selectivity does not show any significant systematic positive effect on either performance measure. The only

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<sup>41</sup> The results of models run with Barron's quality categories collapsed into three categories is also included in the appendices.

**TABLE III. MARGINAL EFFECTS OF COLLEGE QUALITY AND EDUCATION  
VARIABLES IN PROMOTION AND FITREP MODELS**

VARIABLE	Marginal Effect (in percentage points)			
	Operational	Staff	Operational	Staff
	Promotion to O-4		% FITREPs RAP'd	
Mean(%)	75.7	73.7	52.7	55.9
<b>College Quality</b> (Very Competitive Omitted)				
Most Competitive	2.26	9.01*	4.04*	4.36
Highly Competitive	0.38	0.54	4.60***	0.30
Competitive	-1.74	-1.49	-0.79	0.25
Less Competitive	-3.10	-2.93	-1.52	0.60
Non Competitive	-0.74	0.23	-2.26	-2.19
<b>College Major</b> (Humanities Omitted)				
Engineering	2.27	1.22	-1.33	-5.76**
Physical Science	1.72	1.36	-0.81	-2.55**
Math	5.06	-4.71	-5.95***	-4.79*
Social Science	1.70	3.87*	0.19	2.16
Business/Economics	3.10*	4.46**	1.10	2.81*
<b>Other Education Factors</b>				
Grade Point Average Measure	2.28***	1.84***	2.90***	1.50**
Graduate Degree	2.25***	9.16***	-	-

\*\*\* - significant at 99 percent

\*\* - significant at 95 percent

\* - significant at 90 percent

college quality categories found statistically significant are in the Operational FITREP model and one in the staff promotion model. Officers who graduate from colleges rated "most competitive" by Barron's receive on average 4.04 percentage points more than the mean (55.9 percent) FITREPs on which they are recommended for early promotion. "Highly competitive" schools' graduates receive RAP'd FITREPs 4.6 percentage points more than the mean. OCS officers from colleges rated "most competitive" are 9.01 percentage points more likely to promote to Grade O-4. All other college quality categories are statistically insignificant.

There are several plausible explanations for the lack of relationship between college quality and job performance for OCS officers in the Navy. One reason the college selectivity variables may not be significant across all models is the high concentration of individuals in the middle quality categories in this sample. Without an even distribution of individuals in all categories, possibly accurate estimates could not be obtained.

A second possibility lies in the measures used in previous research. Most of the studies outlined in the Literature Review chapter examine civilian samples, with the exception of Wales, who used the Thorndike-NBER database, and Bowman/Mehay, who utilized the same database as this

thesis. Additionally, these studies use earnings as a measure of performance. None of the studies employ measures of performance similar to this thesis's measures, with the exception of Bowman and Mehay.<sup>42</sup> The higher earnings for graduates of the most selective schools may be attributed to the screening hypothesis rather than the productivity-augmentation hypothesis. Employers may presume more selective schools perform an optimal sort of individuals through their screening process or produce more productive graduates. For these reasons, they are willing to compete for these graduates by offering higher salaries. In the Navy, for the OCS group sampled, the evidence does support the hypothesis that college quality and superior performance are positively related, but not as strongly as expected.

## **2. College Major**

The impact of college major on job performance is another focus of this thesis. A popular hypothesis in the Navy contends engineering and science backgrounds are the best academic preparation for naval officers. Previous research into this question finds no basis for this theory.<sup>43</sup> The modeling results in this thesis also find no

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<sup>42</sup> Wise (1975a) did use the "rate of promotion" but not any form of supervisor evaluation.

<sup>43</sup> Bowman, William R., 1990. "Do Engineers Make Better Officers?"

performance premium for OCS officers with engineering and science majors.

As seen in Table III, in the promotion models for both the operational and staff communities none of the engineering, physical science, or math major variables are statistically significant in comparison to the omitted category humanities majors. In some of the same models, Business/Economics and Social Science are significant and positive. A Business/Economics major in the operational promotion model is 3.10 percentage points more likely to promote to Grade O-4 than on average (75.7 percent). In the staff promotion model, Business/Economics and Social Science majors are 4.46 and 3.87 percentage points, respectively, more likely to promote to LCDR than on average (73.7 percent).

While the promotion model results regarding college majors are somewhat surprising, the results in the FITREP model are rather shocking. In the staff FITREP model, engineering, physical science, and math are all significant and negative when compared to humanities, which is omitted. Individuals with Bachelor's degrees in these fields receive 5.76, 2.55, and 4.73 percentage points, respectively, fewer FITREPs RAP'd than the average (55.9 percent). In the operational FITREP model, math is the only statistically

significant major and it is again negative. An OCS operational officer with a math major receives 5.95 percentage points fewer RAP'd FITREPs than the mean of 52.7 percent. The only statistically significant positive impact on the percentage of FITREPs recommended for early promotion is in the Business/Economics major for staff FITREP model. An officer with this background receives RAP'd FITREPs 2.81 percentage points greater than the mean, though the estimator is significant only at the 90 percent level.

In the operational FITREP model, the technical fields of engineering, physical science, and math exhibit no significant impact on promotion to Grade O-4. The only majors which significantly and positively impacted promotion are in non-technical fields. A reason for this result could lie in the management training received in non-technical majors. Perhaps those with more managerial training obtain better leadership and "people" skills than those with engineering backgrounds.

The results from the staff FITREP model support either of the skill augmentation or screening theories. Perhaps people with these innate skills are more likely to pursue academic majors in these fields. Staff officers hold billets which are generally defined as support billets. Given the negative impact of a technical background in the

staff FITREP model, perhaps management skills are more highly valued in the support communities than technical expertise. In addition to the leadership role every naval officer assumes upon commission, officers in staff communities are involved in negotiating contracts and public relations. In these roles, management, business, and people skills are all important to success.

If this is true, this may explain why there is such a negative impact on staff officers in the FITREP model. But why is this negative impact not reflected in the staff promotion model? Perhaps, some staff jobs require specialized technical skills, such as in the Civil Engineering Corps, and therefore must be promoted to fill vacant billets. Additionally, officers with majors in the engineering, physical science, and math academic fields account for only 26.8 percent of the OCS staff sample. This low percentage may not greatly effect the other 73.2 percent of the OCS staff sample.

### **3. Grade Point Average and Graduate School**

While no relationship is evident between college quality and promotion, a highly significant and positive relationship is found between grades, promotion, and FITREPs RAP'd in each OCS community. The measure of college GPA is derived from the Academic Performance Code (APC) on the

Officer Data Card. As described in Chapter III, a number from 0 to 5 is assigned to an individual's cumulative collegiate grade point average. For example an APC1 value of 0 is equivalent to a GPA in the 3.6 to 4.0 range. When describing the marginal effects of the GPA measure, an increase of 1 in the GPA measure is equivalent to a 0.4 increase in cumulative grade point average.

Table IV shows the marginal effects of each grade point average range in of the Academic Performance Code (APC) described in Chapter III. These marginal effects are derived by calculating the promotion rate at the mean value of all variables in the logit model, and then changing the GPA value to match the corresponding collegiate grade point average range. The difference between the mean promotion rate and the promotion rate calculated with the category value is the marginal effect.

In the operational promotion model, an OCS officer with a cumulative GPA greater than 3.6 has a 5.62 percentage point increased likelihood than the mean (75.7 percent) of promotion to Grade O-4. An operational officer with a GPA between 2.0 and 2.39 is 5.41 percentage points less likely than the average to promote. For the staff promotion model, the results are similar; a positive and significant impact for higher grades. officers with a GPA greater than 3.6 are

3.99 percentage points more likely to promote than the mean (73.7 percent). For staff officers in the 2.0 to 2.39 grade point average range, a 5.19 percentage point disadvantage compared to the mean exists.

**Table IV. Marginal Effects of Collegiate GPA Ranges**

VARIABLE	Marginal Effect (in percentage points)	
	Operational	Staff
GPA 3.6 to 4.0	5.62***	3.99***
GPA 3.2 to 3.59	3.05***	1.81***
GPA 2.8 to 3.19	0.36***	-0.46***
GPA 2.4 to 2.79	-2.47***	-2.79***
GPA 2.0 to 2.39	-5.41***	-5.19***
GPA below 2.0	-8.43***	-7.65***

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

In the FITREP models, different marginal effects can not be calculated since the model employed the ordinary least square regression technique. For the operational OCS sample, a 0.4 point increase in GPA causes to a 2.9 percentage point increase, on average, in the percentage of FITREPs RAP'd. This equates to a 7.25 percentage point increase for a 1 point GPA increase. In the staff FITREP model, a 0.4 point increase in GPA leads to a 1.5 percentage point increase in FITREPs RAP'd. A one letter grade increase, from C to B or B to A, implies a 3.75 percentage point increase in FITREPs RAP'd.

These OCS results support what previous research has found: those who perform better in college perform better in the workforce. Perhaps those who receive higher grade point averages in college actually learn more, and GPA acts as an index of knowledge. Another possibility is that those with higher college GPA's have a greater propensity for hard work. Whatever the reason, OCS officers who earn higher grades in college tend to perform better in the Fleet.

Graduate education is another educational characteristic examined in the promotion model. As explained in Chapter III, graduate education is omitted from the FITREP models but is included in the promotion models. While a graduate degree is not statistically significant in the operational model, in the staff model possession of a Master's degree leads to a 9.16 percentage point increase in the probability of promotion.

The results support the hypothesis that graduate education enhances an individual's performance and subsequently their chances of promotion. This theory is based on human capital theory. The fact that graduate school is not significant in the operational model may be influenced by the perception of graduate school in the operational communities. In the operational communities,

especially the aviation community, graduate education is not greatly emphasized.

Another possibility is that the gain acquired from graduate school is offset by the loss of time in the Fleet. When an officer enters a full-time graduate program, they are not competitively rated during this period. Their peers in the operational communities are being competitively evaluated and do not experience the two years of "lost time" those in full-time graduate programs experience. In the staff communities, graduate education is not only stressed, but a Master's degree is valued at the Grade O-4 selection board. The time spent in a full-time graduate program is not perceived as "lost time" in an officer's career. This value is clearly seen in the promotion model results. This may account for the difference in statistical significance of graduate education in the two communities for OCS officers.

#### **4. Navy Officer Community**

In this section the statistical differences between the officer specialties within the OCS operational and staff sample is detailed. Table V displays the marginal effects of each officer specialty and gives their statistical significance.

**TABLE V. MARGINAL EFFECTS OF COMMUNITY AND DEMOGRAPHIC  
VARIABLES IN PROMOTION AND FITREP MODELS**

	Marginal Effect (in percentage points)			
	Operational	Staff	Operational	Staff
	Promotion to O-4		% FITREPs RAP'd	
Mean(%)	75.7	73.7	52.7	55.9
<b>Navy Officer Community</b> (Surface Warfare and GURL Omitted)				
Submarine	-6.31**	-	5.83***	-
Pilot	-2.97**	-	-0.95	-
Naval Flight Officer	-5.17***	-	4.87***	-
Other URL	-22.8***	-	-	-
Staff	-	0.9	-	6.40***
Restricted Line	-	5.79**	-	10.17***
<b>Demographics</b> (Single Omitted from marital status)				
Married w/ No Children	4.18**	3.82*	4.95***	3.75***
Married w/ Children	8.32***	2.90*	6.14***	6.25***
Divorced w/ Children	-1.03***	-0.40	0.32	9.17**
Female	12.20***	6.18**	8.27***	5.61***
Minority	-0.37	1.19	-8.92***	-6.24***
Age at Commissioning	-1.30***	0.04	-0.89***	0.14

\*\*\* - significant at 99 percent

\*\* - significant at 95 percent

\* - significant at 90 percent

In the operational promotion model, the warfare communities are significant and negative compared to the omitted group of Surface Warfare. The negative relationship may be due to the larger size of the Surface Warfare community.<sup>44</sup> Like the operational promotion model, some of the community variables are significant in the operational FITREP model. In this model the relationship is positive, whereas the promotion model indicates a negative relationship with the omitted group Surface Warfare. Both Submariners and Naval Flight Officers are positive and significant categories with OLS estimates of 5.83 and 4.87, respectively. The Pilot community is insignificant in this model.

That Surface Warfare officers are less likely to receive a RAP'd evaluation, according to these results, is not surprising. The perception is that Surface Warfare officers are rated more harshly by their superiors than junior officers in the other operational communities. The Surface Warfare community has the reputation of being tougher than other communities in the evaluation of their

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<sup>44</sup> The result from the other URL category, 22.8 percentage point negative impact, is eye opening, but this may reflect a mismatch of grouping these officers with the other three warfare communities. The disparity could also be a reflection on the specialized and dangerous nature of SEAL and EDO duty. Also, the sample included only 22 individuals in the other URL category.

junior officers. Surface Warfare officers also perform some of the most demanding jobs in the Navy and are thrust into these assignments with little specialized training, unlike the aviation and the submarine communities. While the results support this anecdotal evidence, as we have seen in the promotion model, at the O-4 promotion board, Surface Warfare officers fare slightly better than their other operational brethren. There is a saying in the Fleet that SWO's "eat their young," but the reward comes in the form of better promotion rates.

In the staff community model the General Unrestricted Line community is the omitted category. While the Staff community is statistically insignificant, the Restricted Line community is significant and positive. Compared to the mean promotion rate, a Restricted Line officer has a 5.79 percentage point advantage in the probability of being promoted to Grade O-4 compared to the General Unrestricted Line.

Both the Staff and Restricted Line variables are significant and positive, receiving, on average, 6.4 and 10.17 percentage points more FITREPs recommended for early promotion compared to General Unrestricted Line. It is uncertain if the disparity between the communities is caused by combining the General Unrestricted Line officers with the

Restricted Line officers and Staff officers or the superior performance of Staff and Restricted Line officers.

## **5. Demographics**

As a group, most of the demographic variables are statistically significant. This is not surprising since previous research suggests that demographics would play an important role in the models. Although most of the variables' effects were correctly predicted, there are several surprises. The marginal effects of the demographic variables are displayed in Table V.

Being a married officer in the Navy is statistically significant and positive in both models and communities compared to the omitted group single officers. The largest marginal effect is in the operational communities. An OCS officer married with children is 8.32 percentage points more likely than average to promote to Grade O-4. Officers in the Staff sample who are married with children have only a 2.90 percentage point advantage. The positive impact of the two married categories was predicted in Chapter III. Perhaps married officers are more mature, more stable, and more dedicated to their job because of their families.

Divorced officers with children are one of the surprising outcomes. While the negative effect in the operational promotion model is expected, a significant and

positive impact is not expected for any model or community. In the staff FITREP model, divorced officers with children receive RAP'd FITREPs 9.17 percentage points more often. Perhaps the Staff communities are more conducive to single parenthood and having a successful naval career. With fewer extended deployments and less time away from home, perhaps the Staff community is the best community in the Navy for a single parent.

For the OCS operational communities, age at the time of commissioning is negative and statistically significant in both the promotion and FITREP models. For every year older, an officer was 1.3 percentage point less likely to promote to O-4 and received 0.89 percentage points fewer RAP'd FITREPs. Some OCS officers have held post-college jobs in the civilian workforce. Perhaps the less able in the civilian workforce turn to the military for a career, and this followed them in the military.

Gender is another surprising category. The prediction in Chapter III was a negative impact for females in both the promotion and FITREP models. Given the unfavorable publicity the military has received in regard to the assimilation of women in the military, the expectation was a negative impact. In fact females are positive and statistically significant in both OCS communities and

performance models. In the operational promotion model, women promote to LCDR 12.2 percentage point greater than the mean. Admittedly, there are only 50 females in a sample size of 2,911. In the staff promotion model, which had 1,311 women out of a sample of 2912, the promotion advantage is 6.18 percentage points above the mean for promotion. In the FITREP model, women again fare better than males. Female operational officers receive 8.27 percentage points more FITREPs RAP'd than the mean (52.7 percent). In the staff community, females are also consistently rated better than males. They receive RAP'd FITREPs 5.61 percentage points more often than the mean (55.9 percent).

Although the performance premium for OCS women in the Navy was not anticipated, there are several possible explanations for the performance models' results. Possibly the minority of women who select a career as a naval officer are "above average" compared to the general female population. Males who tend to join the military may be more typical of the population of males.

Minority status is the final demographic characteristic utilized in this thesis. In the FITREP model, the minority variable is statistically significant and negative. In the operational sample, minority OCS officers receive, on average, 8.92 percentage points fewer RAP'd FITREPs. For

the staff sample the disadvantage is 6.24 percentage points fewer recommendations for early promotion. These results were anticipated.

What was not anticipated is the results from the promotion model. The logical expectation is that the negative impact on minorities from the FITREP model would also reflect in the promotion model. In the FITREP model, minority status is statistically insignificant. Although minority officers receive fewer evaluations in which they are recommended for early promotion, at the Grade O-4 selection board there is no negative statistical impact.

The possible causes of the modeling results lie in a politically charged arena. Perhaps the senior officers rating the OCS minority officers in the sample systematically rate them lower than non-minority officers. This could be due to discrimination. The background of minority officers is not investigated in this study. Perhaps minority officers on average do not enter the military with the same skill sets as non-minority OCS officers. Without more focused research into the subject, these are the only hypotheses which seem reasonable.



## V. CONCLUSIONS AND RECOMMENDATIONS

This thesis sought to explore the impact of college quality, college grades, and college major on performance in the Navy. The sample is composed of officers who accessed via Officer Candidate School and who have no prior enlisted experience. The sample is divided into two separate communities: operational and staff. The performance measures used are promotion to Grade O-4 and the percentage of junior officer (Grade O-1 to Grade O-3) FITREPs on which an officer is recommended for early promotion.

While the relationship between college quality and naval officer performance may be tenuous, the results of this thesis show a premium for graduates from only the most elite schools. In the operational FITREP model, those in the "most competitive" category receive RAP'd FITREPs 4.04 percentage points greater than the mean than those in the omitted category of "very competitive." For the staff model, officers in the "most competitive" ranking fare best at the Grade O-4 selection board. Those from the highest quality colleges, on average, are 9.01 percentage points more likely to be promoted to Grade O-4. These results are similar to the findings of Brewer, Eide, and Ehrenberg (1996). They found a significant economic return to attendance at elite, private institutions.

In all iterations, the measure for college grade point average is significant and positive, which supports previous research. James, Conaty, and To found a 9 percent earnings premium for a B to A increase in grade point average. In the operational and staff performance models, a premium on performance is displayed for those in the highest grade point average ranges. In the FITREP models, a one-point increase in grade point average leads to a 2 percentage point increase the number of FITREPs RAP'd in the operational communities and a 1 percentage point increase in the staff communities compared to the mean. This supports previous studies which identify a positive relationship between college academic performance and on-the-job performance.

In view of the results regarding college quality and grade point average, this research most closely resembles that of James, et al. While college major appears to be statistically significant in some specific models, grade point average is always statistically significant and positive. An officer recruitment policy emphasizing GPA slightly higher than college quality is warranted from these results. Admittedly, this conclusion makes no assumption as to the suitability and adaptability of an individual to military life.

College major also has an important impact on officer performance. The hypothesis that engineers make better naval officers is not supported by the modeling results. Technical majors such as engineering and math are statistically insignificant in the promotion model and are significant and negative in the staff FITREP model. Most notably, math is significant and negative for the operational FITREP model. The only major found to be consistently significant and positive is economics/management. Possibly college management courses provide superior preparation compared to technical courses for the challenges of being a junior officer. While this result is not specifically tested in individual communities which are technically oriented, such as submarines, this is a possible topic for future research.

Not surprisingly graduate education produces a major positive impact on promotion, but the effect is significant only in the staff promotion model. This could be due to an emphasis on graduate education in staff communities and a lack of emphasis on graduate education in the operational communities. Although not the focus of this study, the results support officer graduate education and its positive effects on performance. A possible area for further research is to measure an officer's performance before and

after receiving graduate education. This may prove difficult as officers are chosen for graduate education programs based on past superior performance.

The results also suggest that individuals with families are more likely to promote and receive more favorable evaluations. Those who are married or married and have children fare better than single officers in these performance measures. Perhaps married individuals are more mature and motivated to succeed in order to provide for their families. Whatever the reason, married officers tend to perform better. If the Navy is serious about retaining these individuals, perhaps funding for quality of life programs would be a cost-effective way to keep these officers in the Navy.

A puzzling demographic result is that of minority officers. Although they do not fare well on FITREPs, there is no difference in their performance at the Grade O-4 selection board. Is there discrimination in the evaluation of minority officers? If there is discrimination present in the FITREP model, why is it not reflected in the promotion model? The reasons behind the disparity are unknown and this is an area ripe for further research.

Although females do not constitute a large proportion of the Navy, women in this sample of OCS officers perform

better than their male counterparts in the performance measures utilized. This conclusion, especially in the operational communities, is preliminary and is an area recommended for further study. With the recent opening of many combat billets to women, undoubtedly studies will be conducted analyzing their performance.

In conclusion, the evidence from this thesis supports the hypothesis that individuals with better performance in college, as measured by grade point average, will perform better as officers in the Navy. While this thesis also supports a job performance premium for graduates from more selective colleges, the results are not uniform across all iterations of the model. College major also plays a part in the job performance of an officer, but management or economics majors perform better than engineers did. The evidence suggests there is no premium for technical majors over non-technical majors. In fact a premium exists for management oriented majors.

So what should the Navy look for when recruiting officers through the Officer Candidate Program? Evidence here suggests that college performance, as measured by grade point average, is the best predictor of officer performance in this OCS sample. While attendance at a selective school also predicts superior OCS officer performance, only the

most elite schools show a statistically significant impact. Individuals who major in management or social science fields show a slight premium for officer performance.

# APPENDIX A. DESCRIPTION OF DEPENDENT AND EXPLANATORY VARIABLES

VARIABLE NAME	DESCRIPTION	EXPECTED IMPACT ON PERFORMAN CE MEASURES
<b>College Quality</b>		
BARRONS1	= 1 if "most competitive" = 0 if not "most competitive"	+
BARRONS2	= 1 if "highly competitive" = 0 if not "highly competitive"	+
BARRONS3	= 1 if "very competitive" = 0 if not "very competitive"	Omitted group
BARRONS4	= 1 if "competitive" = 0 if not "competitive"	-
BARRONS5	= 1 if "less competitive" = 0 if not "less competitive"	-
BARRONS6	= 1 if "non-competitive" = 0 if not "non-competitive"	-
BARRONHI	= 1 if in BARRONS1 or BARRONS2	+
BARRONMD	= 1 if in BARRONS3 or BARRONS4	+
BARRONLO	= 1 if in BARRONS5 or BARRONS6	Omitted group
<b>Individual Education Characteristics*</b>		
ENGINEER	= 1 if major in Engineering field	?
PHYSICAL	= 1 if major in Physical Science/Biology field	?
MATH	= 1 if major in Math/Computer Science field	?
SOCSCI	= 1 if major in Social Sciences field	?
ECON	= 1 if major in Business/Economics field	?
HUM	= 1 if major in Humanities field	Omitted group
GPA	= college grade point average	+

\* For the remaining binary variables, assume the variable value equals zero if statement is false.

**APPENDIX A (CONT) . DESCRIPTION OF DEPENDENT AND EXPLANATORY VARIABLES**

<b>VARIABLE NAME</b>	<b>DESCRIPTION</b>	<b>EXPECTED IMPACT ON PERFORMANCE MEASURES</b>
GRADSCH	= 1 if attended graduate school	+
<b>Demographics</b>		
FEMALE	= 1 if female	-
NONWHITE	= 1 if nonwhite	-
AGE	= age at Ensign commissioning	?
SINGLE	= 1 if single/divorced	Omitted group
MARONLY	= 1 if married w/o children	+
MARCHILD	= 1 if married with children	+
DIVCHILD	= 1 if divorced with children	?
<b>Year Dummy Variables (For Promotion model)</b>		
FY85 - FY95	= 1 if O-4 board was in that year	?
<b>Year Dummy Variables (For FITREP model)</b>		
LTJG78 - LTJG88	= 1 if promoted to O-2 in that year	?

Note: The year in which an individual promoted to Grade O-2 was used vice the more traditional year commissioned an Ensign (year group) due to errors in coding the year group in the original data set.

# APPENDIX B. VARIABLE MEANS AND STANDARD DEVIATIONS

VARIABLES	MEAN (STANDARD DEVIATION)			
	URL (PROMO) N= 2911	URL (PCTRAP) N= 5329	RL (PROMO) N= 2240	RL (PCTRAP) N= 2912
<b>DEPENDENT VARIABLES</b>				
PROMO	.757 (.429)	-	.737 (.441)	-
PCTRAP	-	.527 (.314)	-	.559 (.289)
<b>EXPLANATORY VARIABLES</b>				
<b>College Quality</b>				
BARRONS1	.025 (.155)	.031 (.173)	.023 (.151)	.032 (.176)
BARRONS2	.072 (.258)	.077 (.264)	.062 (.241)	.060 (.238)
BARRONS3	.326 (.469)	.319 (.466)	.329 (.470)	.340 (.473)
BARRONS4	.370 (.483)	.358 (.479)	.348 (.476)	.324 (.468)
BARRONS5	.099 (.298)	.098 (.297)	.097 (.296)	.098 (.298)
BARRONS6	.069 (.253)	.068 (.251)	.060 (.238)	.061 (.239)
BARRONHI	.099 (.295)	.106 (.308)	.085 (.279)	.092 (.290)
BARRONMD	.696 (.460)	.678 (.468)	.677 (.468)	.664 (.472)
BARRONLO	.167 (.373)	.165 (.372)	.158 (.364)	.159 (.366)
<b>Navy Community</b>				
SWO	.281 (.450)	.409 (.492)	-	-
SUB	.090 (.286)	.122 (.328)	-	-
PLT	.363 (.481)	.299 (.458)	-	-
NFO	.258 (.438)	.169 (.375)	-	-
OTHURL	.008 (.087)	0.00 (0.00)	-	-
STAFF	-	-	.313 (.464)	.368 (.482)
RL	-	-	.335 (.472)	.228 (.419)
GURL	-	-	.352 (.478)	.404 (.491)
<b>Demographics</b>				
MARONLY	.249 (.432)	.307 (.461)	.178 (.383)	.196 (.397)
MARCHILD	.536 (.499)	.159 (.366)	.366 (.482)	.112 (.315)
DIVCHILD	.016 (.127)	.006 (.077)	.028 (.165)	.016 (.127)
SINGLE	.199 (.399)	.528 (.500)	.428 (.495)	.675 (.468)
FEMALE	.017 (.130)	.019 (.135)	.431 (.495)	.450 (.498)
MALE	.983 (.130)	.981 (.135)	.569 (.495)	.550 (.498)
NONWHITE	.036 (.187)	.047 (.211)	.070 (.255)	.060 (.237)
WHITE	.964 (.187)	.953 (.211)	.930 (.255)	.940 (.237)
AGE	23.9 (2.086)	23.9 (2.074)	24.4 (2.46)	24.3 (2.37)

APPENDIX B. (CONT.) VARIABLE MEANS

VARIABLES	MEAN (STANDARD DEVIATION)			
	URL (PROMO) N= 2911	URL (PCTRAP) N= 5329	RL (PROMO) N= 2240	RL (PCTRAP) N= 2912
<b>Education</b>				
GRADSCH	.175 (.380)	.111 (.314)	.294 (.456)	.209 (.408)
ENGINEER	.148 (.356)	.172 (.378)	.050 (.217)	.038 (.192)
PHYSICAL	.222 (.416)	.211 (.408)	.176 (.381)	.151 (.358)
MATH	.036 (.187)	.042 (.201)	.042 (.200)	.036 (.186)
SOCSCI	.167 (.373)	.166 (.372)	.192 (.394)	.194 (.396)
ECON/BUSINESS	.201 (.401)	.197 (.398)	.266 (.442)	.307 (.461)
HUM	.147 (.354)	.138 (.345)	.229 (.420)	.238 (.426)
GPA	2.874 (.954)	2.952 (.946)	3.20 (.885)	3.23 (.879)
<b>Year Dummy Variables</b>				
FY85	.045 (.207)	-	.063 (.244)	-
FY86	.090 (.287)	-	.079 (.269)	-
FY87	.091 (.288)	-	.131 (.337)	-
FY88	.054 (.226)	-	.078 (.268)	-
FY89	.134 (.341)	-	.106 (.308)	-
FY90	.125 (.331)	-	.106 (.308)	-
FY91	.142 (.349)	-	.131 (.337)	-
FY92	-	-	-	-
FY93	.135 (.342)	-	.098 (.297)	-
FY94	.075 (.263)	-	.068 (.252)	-
FY95	.108 (.311)	-	.105 (.307)	-
JGYG78	-	.001 (.036)	-	-
JGYG79	-	.083 (.276)	-	.115 (.320)
JGYG80	-	.096 (.295)	-	.123 (.328)
JGYG81	-	.103 (.304)	-	.120 (.325)
JGYG82	-	.129 (.336)	-	.142 (.349)
JGYG83	-	.181 (.385)	-	.143 (.350)
JGYG84	-	.121 (.326)	-	.095 (.293)
JGYG85	-	.071 (.258)	-	.078 (.072)
JGYG86	-	.096 (.294)	-	.072 (.259)
JGYG87	-	.118 (.323)	-	.066 (.249)

**APPENDIX C. LOGIT RESULTS OF OPERATIONAL PROMOTION MODEL #1**  
(BARRON'S GROUPED IN SIX CATEGORIES)

<b>VARIABLE</b>	<b>Logit Estimate</b>	<b>Chi-square</b>	<b>Marginal Effect (percentage points)</b>
INTERCEPT	2.0318	29.948	-
<b>College Quality</b> (BARRONS3 Omitted)			
BARRONS1	.1067	.346	2.26
BARRONS2	.0177	.026	0.38
BARRONS4	-.0792	1.676	-1.74
BARRONS5	-.1404	2.328	-3.10
BARRONS6	-.0342	.0984	-0.74
<b>URL Community</b> (SWO Omitted)			
SUB	-.2881**	6.091	-6.31
PLT	-.1393*	3.887	-2.97
NFO	-.2380***	11.032	-5.17
OTHURL	-.9640***	12.084	-22.8
<b>Demographics</b> (SINGLE Omitted)			
MARONLY	.1816**	5.531	4.18
MARCHILD	.3722***	29.303	8.32
DIVCHILD	-.0687***	.122	-1.03
FEMALE	.6334***	6.838	12.2
NONWHITE	-.0167	.0146	-0.37
AGE	-.0757***	32.283	-1.30
<b>Education</b> (HUM Omitted)			
GRADSCH	.1037	1.993	2.25
ENGINEER	.1022	1.186	2.27
PHYSICAL	.0768	.943	1.72
MATH	.2335	2.245	5.06
SOCSCI	.0762	.821	1.70
ECON	.1403*	2.978	3.10
GPA	.1266***	17.53	2.28

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

APPENDIX C. (CONT.) LOGIT RESULTS OF OPERATIONAL PROMOTION  
 MODEL #1  
 (BARRON'S GROUPED IN SIX CATEGORIES)

VARIABLE	Logit Estimate	Chi-square	Marginal Effect (percentage points)
O-4 Selection Board Year (FY85 Omitted)			
FY86	-.0461	.093	-1.01
FY87	-.1594	1.118	-3.56
FY88	-.0721	.185	-1.59
FY89	.1182	.654	2.52
FY90	-.0751	.267	-1.66
FY91	.1055	.532	2.25
FY93	.0270	.034	-0.59
FY94	-.1596	1.022	-3.57
FY95	-.1417	.904	-3.16

Chi-Square Log Likelihood: 133.795

2,911 Observations

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX D. LOGIT RESULTS OF OPERATIONAL PROMOTION MODEL #2**  
(BARRON'S GROUPED IN THREE CATEGORIES)

<b>VARIABLES</b>	<b>Logit Estimate</b>	<b>Chi-square</b>	<b>Marginal Effect (percentage points)</b>
INTERCEPT	1.9836	28.062	-
<b>College Quality</b> (BARRONLO Omitted)			
BARRONHI	.1093	1.094	2.39
BARRONMD	.0254*	.1521	0.55
<b>URL Community</b> (SWO Omitted)			
SUB	-.2869**	6.056	-6.31
PLT	-.1390**	3.883	-2.98
NFO	-.2408***	11.311	-5.26
OTHURL	-.9618***	12.033	-22.8
<b>Demographics</b> (SINGLE Omitted)			
MARONLY	.1841**	5.706	4.25
MARCHILD	.3734***	29.617	8.37
DIVCHILD	-.0570	.0846	-1.36
FEMALE	.6339***	6.878	12.3
NONWHITE	-.0196	.020	-0.45
AGE	-.0760***	32.678	-1.37
<b>Education</b> (HUM Omitted)			
GRADSCH	.1140	2.411	2.48
ENGINEER	.0995	1.126	0.22
PHYSICAL	.0656	.685	1.46
MATH	.2181	1.963	4.72
SOCSCI	.0669	.629	1.55
ECON	.1253	2.392	2.75
GPA	.1266***	17.57	2.29

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX D. (CONT.) LOGIT RESULTS OF OPERATIONAL PROMOTION  
MODEL #2  
(BARRON'S GROUPED IN THREE CATEGORIES)**

<b>VARIABLE</b>	<b>Logit Estimate</b>	<b>Chi-square</b>	<b>Marginal Effect (percentage points)</b>
<b>O-4 Selection Board Year (FY85 Omitted)</b>			
FY86	-.0574	.144	-1.25
FY87	-.1662	1.216	-3.72
FY88	-.0785	.220	-1.74
FY89	.1124	.592	2.40
FY90	-.0846	.339	1.88
FY91	.0929	.413	1.99
FY93	.0165	.013	0.37
FY94	-.1651	1.096	-3.70
FY95	-.1472	.976	-3.28

Chi-Square Log Likelihood: 130.728

2,911 Observations

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX E. LOGIT RESULTS OF STAFF PROMOTION MODEL #1**  
(BARRON'S GROUPED IN SIX CATEGORIES)

<b>VARIABLES</b>	<b>Logit Estimate</b>	<b>Chi-square</b>	<b>Marginal Effect (percentage points)</b>
INTERCEPT	-.00754	.0004	-
<b>College Quality</b> (BARRONS3 Omitted)			
BARRONS1	.4404*	3.650	9.01
BARRONS2	.0246	.037	0.54
BARRONS4	-.0658	.959	-1.49
BARRONS5	-.1286	1.59	-2.93
BARRONS6	.0107	.007	0.23
<b>URL Community</b> (GURL Omitted)			
STAFF	.0392	.093	0.9
RL	.2605**	5.126	5.79
<b>Demographics</b> (SINGLE Omitted)			
MARONLY	.1710*	3.747	3.82
MARCHILD	.1291*	2.902	2.90
DIVCHILD	-.0171	.009	-0.40
FEMALE	.2777**	5.754	6.18
NONWHITE	.0537	.208	1.19
AGE	.00226	.032	0.04
<b>Education</b> (HUM Omitted)			
GRADSCH	.4209***	36.241	9.16
ENGINEER	.0533	.129	1.22
PHYSICAL	.0597	.427	1.36
MATH	-.1991	1.727	-4.71
SOCSCI	.1732*	3.773	3.87
ECON	.1994**	4.894	4.46
GPA	.1019***	8.513	1.84

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX E. (CONT.) LOGIT RESULTS OF STAFF PROMOTION MODEL #1**  
**(BARRON'S GROUPED IN SIX CATEGORIES)**

<b>VARIABLE</b>	<b>Logit Estimate</b>	<b>Chi- square</b>	<b>Marginal Effect (percentage points)</b>
<b>O-4 Selection Board Year (FY85 Omitted)</b>			
FY86	-.2428*	2.739	-5.30
FY87	-.2020	2.564	-4.38
FY88	-.1878	1.730	-4.07
FY89	-.2586*	3.619	-5.66
FY90	-.3388**	6.579	-7.51
FY91	-.0763	.351	-1.62
FY93	-.1748	1.610	-3.77
FY94	-.4646***	10.217	-10.49
FY95	-.1992	2.219	-4.32

Chi-Square Log Likelihood: 103.137

2,240 Observations

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX F. LOGIT RESULTS OF STAFF PROMOTION MODEL #2**  
(BARRON'S GROUPED IN THREE CATEGORIES)

<b>VARIABLES</b>	<b>Logit Estimate</b>	<b>Chi-Square</b>	<b>Marginal Effect (percentage points)</b>
INTERCEPT	-.0994	.0646	-
<b>College Quality</b> (BARRONLO Omitted)			
BARRONHI	.1908	2.465	5.21
BARRONMD	.0404	.338	1.92
<b>URL Community</b> (GURL Omitted)			
STAFF	.0470	.134	1.09
RL	.2692**	5.478	5.99
<b>Demographics</b> (SINGLE Omitted)			
MARONLY	.1741**	3.895	3.89
MARCHILD	.1228	2.634	2.76
DIVCHILD	-.0045	.0007	-0.11
FEMALE	.2813**	5.903	6.28
NONWHITE	.0692	.347	1.57
AGE	.0026	.041	.047
<b>Education</b> (HUM Omitted)			
GRADSCH	.4234***	36.784	9.21
ENGINEER	.0432	.086	0.99
PHYSICAL	.0632	.480	1.44
MATH	-.1892	1.565	-4.48
SOCSCI	.1795**	4.070	4.03
ECON	.1990**	4.880	4.45
GPA	.1021***	8.550	1.84

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX F. (CONT.) LOGIT RESULTS OF STAFF PROMOTION MODEL #2**  
**(BARRON'S GROUPED IN THREE CATEGORIES)**

<b>VARIABLE</b>	<b>Logit Estimate</b>	<b>Chi-square</b>	<b>Marginal Effect (percentage points)</b>
<b>O-4 Selection Board Year (FY85 Omitted)</b>			
FY86	-.2327	2.526	-5.08
FY87	-.1994	2.504	-4.33
FY88	-.1841	1.671	-3.99
FY89	-.2489*	3.367	-5.45
FY90	-.3281**	6.189	-7.28
FY91	-.0707	.033	-1.50
FY93	-.1621	1.393	-3.50
FY94	-.4588**	10.006	-10.37
FY95	-.1954	2.141	-4.24

Chi-Square Log Likelihood: 98.570

2,240 Observations

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX G. OLS RESULTS OF OPERATIONAL FITREP MODEL #1**  
**(BARRON'S GROUPED IN SIX CATEGORIES)**

<b>VARIABLE</b>	<b>OLS Estimate</b>	<b>T stat</b>
INTERCEPT	52.78	4.481
<b>College Quality</b> (BARRONS3 Omitted)		
BARRONS1	4.048*	1.681
BARRONS2	4.596***	2.828
BARRONS4	-0.794	-0.830
BARRONS5	-1.521	-1.043
BARRONS6	-2.262	-1.329
<b>URL Community</b> (SWO Omitted)		
SUB	5.836***	3.796
PLT	-0.949	-0.936
NFO	4.873***	4.107
<b>Demographics</b> (SINGLE Omitted)		
MARONLY	4.951***	5.335
MARCHILD	6.139***	5.138
DIVCHILD	0.316	0.060
FEMALE	8.269***	2.715
NONWHITE	-8.917***	-4.551
AGE	-0.896***	-4.147
<b>Education</b> (HUM Omitted)		
ENGINEER	-1.331	-0.919
PHYSICAL	-0.806	-0.635
MATH	-5.956***	-2.700
SOCSCI	0.193	0.144
ECON	1.101	0.846
GPA	2.897***	6.142

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX G. (CONT.) OLS RESULTS OF OPERATIONAL FITREP MODEL  
#1  
(BARRON'S GROUPED IN SIX CATEGORIES)**

VARIABLE	OLS Estimate	T stat
<b>O-2 Selection Board Year (JGYG78 Omitted)</b>		
JGYG79	-2.753	-0.262
JGYG80	-2.935	-0.279
JGYG81	2.076	0.198
JGYG82	4.265	0.407
JGYG83	10.055	0.960
JGYG84	13.693	1.305
JGYG85	24.773**	2.351
JGYG86	21.558**	2.052
JGYG87	19.140*	1.824

R-squared: .1377  
Adj R-squared: .1329  
F-statistic: 28.211

5,329 Observations

\*\*\* - significant at 99 percent  
\*\* - significant at 95 percent  
\* - significant at 90 percent

APPENDIX H. OLS RESULTS OF OPERATIONAL FITREP MODEL #2  
(BARRON'S GROUPED IN THREE CATEGORIES)

VARIABLE	OLS Estimate	T stat
INTERCEPT	54.626	4.657
<b>College Quality</b> (BARRONLO Omitted)		
BARRONHI	6.332***	4.129
BARRONMD	2.339**	2.321
<b>URL Community</b> (SWO Omitted)		
SUB	6.513***	4.274
PLT	-0.022	-0.022
NFO	4.955***	4.212
<b>Demographics</b> (SINGLE Omitted)		
MARONLY	4.492***	4.877
MARCHILD	5.833***	4.929
DIVCHILD	-0.589	-0.112
FEMALE	7.272**	2.407
NONWHITE	-8.575***	-4.419
AGE	-1.104***	-5.119
<b>Education</b> (HUM Omitted)		
ENGINEER	-1.291	-0.897
PHYSICAL	-0.970	-0.765
MATH	-6.583***	-3.005
SOCSCI	0.481	0.359
ECON	1.198	0.923
GPA	2.370	5.031

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX H. (CONT.) OLS RESULTS OF OPERATIONAL FITREP MODEL  
#2  
(BARRON'S GROUPED IN THREE CATEGORIES)**

VARIABLE	OLS Estimate	T stat
<b>O-2 Selection Board Year (JGYG78 Omitted)</b>		
JGYG79	-1.870	-0.179
JGYG80	-2.288	-0.220
JGYG81	2.985	0.287
JGYG82	5.237	0.504
JGYG83	10.878	1.048
JGYG84	14.249	1.369
JGYG85	25.063**	2.399
JGYG86	21.854**	2.097
JGYG87	20.650**	1.984

R-squared: .1384  
Adj R-squared: .1340  
F-statistic: 31.530

5,329 Observations

\*\*\* - significant at 99 percent  
\*\* - significant at 95 percent  
\* - significant at 90 percent

**APPENDIX I. OLS RESULTS OF STAFF FITREP MODEL #1**  
(BARRON'S GROUPED IN SIX CATEGORIES)

<b>VARIABLE</b>	<b>OLS Estimate</b>	<b>T stat</b>
INTERCEPT	33.725	5.001
<b>College Quality</b> (BARRONS3 Omitted)		
BARRONS1	4.365	1.526
BARRONS2	0.300	0.141
BARRONS4	0.249	0.218
BARRONS5	0.604	0.349
BARRONS6	-2.194	-1.031
<b>URL Community</b> (GURL Omitted)		
STAFF	6.401***	3.296
RL	10.166***	5.440
<b>Demographics</b> (Single Omitted)		
MARONLY	3.754***	2.850
MARCHILD	6.248***	3.667
DIVCHILD	9.175***	2.346
FEMALE	5.608***	3.143
NONWHITE	-6.239***	-2.944
AGE	0.142	0.624
<b>Education</b> (HUM Omitted)		
ENGINEER	-5.763**	-2.064
PHYSICAL	-2.553	-1.600
MATH	-4.794*	-1.716
SOCSCI	2.164	1.463
ECON	2.812*	1.878
GPA	1.503**	2.563

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX I. (CONT.) OLS RESULTS OF STAFF FITREP MODEL #1**  
**(BARRON'S GROUPED IN SIX CATEGORIES)**

VARIABLE	OLS Estimate	T stat
<b>O-2 Selection Board Year</b> (JGYG78 Omitted)		
JGYG79	-8.678***	-3.203
JGYG80	-6.135**	-2.270
JGYG81	-2.222	-0.816
JGYG82	1.032	0.387
JGYG83	5.534**	2.079
JGYG84	12.163***	4.290
JGYG85	25.403***	8.713
JGYG86	20.325***	6.895
JGYG87	19.067***	6.373

R-squared: .1994  
 Adj R-squared: .1913  
 F-statistic: 24.750

2,912 Observations

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

**APPENDIX J. OLS RESULTS OF STAFF FITREP MODEL #2**  
**(BARRON'S GROUPED IN THREE CATEGORIES)**

<b>VARIABLE</b>	<b>OLS Estimate</b>	<b>T Stat</b>
INTERCEPT	38.7598	5.726
<b>College Quality</b> (BARRONLO Omitted)		
BARRONHI	2.7981	1.476
BARRONMD	1.3571	1.180
<b>URL Community</b> (GURL Omitted)		
STAFF	7.0575***	3.675
RL	10.4702***	5.675
<b>Demographics</b> (SINGLE Omitted)		
MARONLY	3.5278***	2.710
MARCHILD	5.7478***	3.412
DIVCHILD	9.6670**	2.502
FEMALE	4.9914***	2.830
NONWHITE	-6.0597***	-2.889
AGE	-0.1139	-0.504
<b>Education</b> (HUM Omitted)		
ENGINEER	-6.7571**	-2.449
PHYSICAL	-3.8080**	-2.408
MATH	-5.7190**	-2.073
SOCSCI	1.4918	1.020
ECON	2.5785*	1.745
GPA	1.0443*	1.794

\*\*\* - significant at 99 percent  
 \*\* - significant at 95 percent  
 \* - significant at 90 percent

APPENDIX J. (CONT.) OLS RESULTS OF RL FITREP MODEL #2  
(BARRON'S GROUPED IN THREE CATEGORIES)

VARIABLE	OLS Estimate	(Pr > t)
<b>O-2 Selection Board Year (JGYG78 Omitted)</b>		
JGYG79	-9.0305***	-3.375
JGYG80	-5.9660**	-2.237
JGYG81	-1.7273	-0.642
JGYG82	1.3275	0.504
JGYG83	5.4828**	2.084
JGYG84	11.889***	4.246
JGYG85	24.6452***	8.554
JGYG86	20.5504***	7.062
JGYG87	19.302***	6.533

R-squared: .1990  
Adj R-squared: .1918  
F-statistic: 27.571

2,912 Observations

\*\*\* - significant at 99 percent  
\*\* - significant at 95 percent  
\* - significant at 90 percent

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